CALIFORNIA
OIL WORLD
and Petroleum Industry

PUBLISHED TWICE A MONTH — ENGINEERING — TECHNOLOGY — LATEST NEWS

SECOND ISSUE
FEBRUARY 1941
VOL. 34 NO. 4
WHOLE NO. 1579

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California Oil World and Petroleum Industry is published twice a month at 828 Petroleum Bldg., 714 West Olympic Blvd., Los Angeles, California. Entered as Second-class Matter January 1, 1937, at the post office at Los Angeles, California, under the Act of March 3, 1879. Subscription price: $1 per year in U. S. and Possessions, $2 in foreign countries, including Canada. Member of the Audit Bureau of Circulations.

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Some Ideas on the Extension of Torrance-

Wilmington Productive Area

By Vernon L. King and
Harold M. Preston
Petroleum Engineers and Geologists
Los Angeles

The firm of King & Preston is made up of two of the best known geological and engineering consultants in the California oil industry. Vernon L. King graduated in geology from Stanford University in 1916 following which he was employed by Midwest Oil Co. in Wyoming until entering military service the following year. At the close of the war, Mr. King returned to Los Angeles and resumed his professional career which since has taken him to nearly every important oil producing area in the United States. At various times he has been connected with major companies but for the past twelve years he has engaged in consulting work specializing in California.

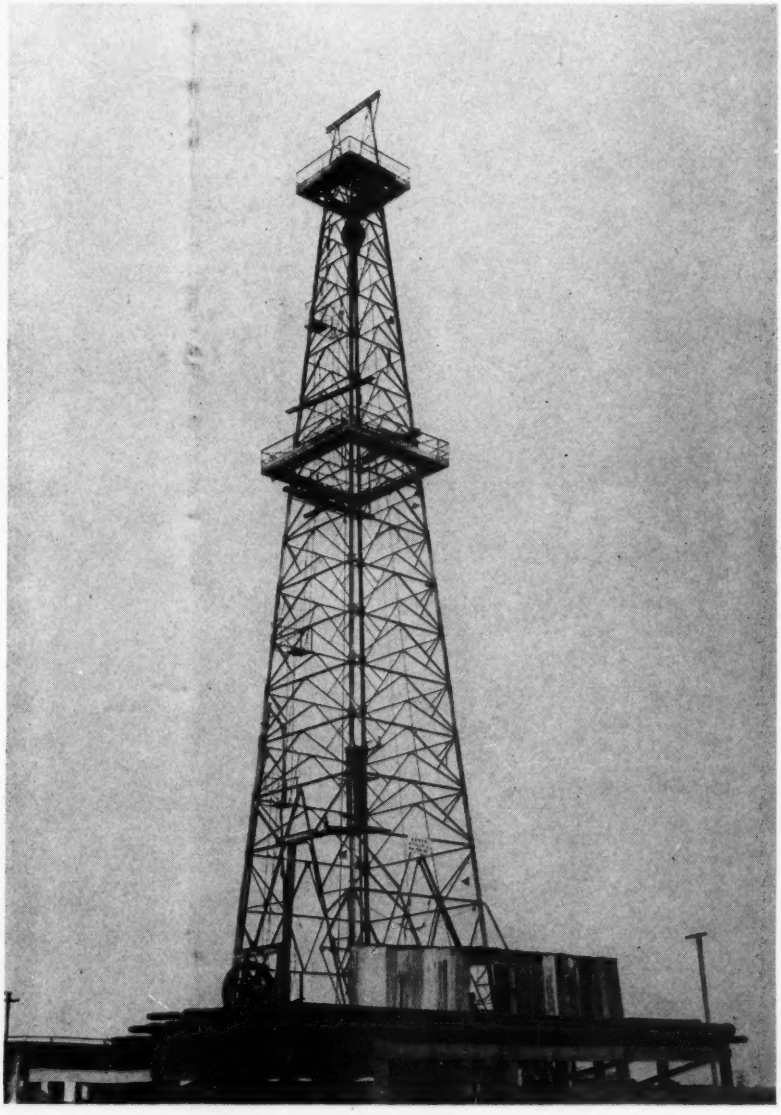
Harold M. Preston majored in Petroleum engineering and geology at University of California, graduating in 1925. For many years he was employed as regional engineer with the State Division of Oil & Gas where he gained wide experience in the geological and engineering problems encountered throughout the state. During the past few years, Mr. Preston has become one of the best known consultants in California.

Recently Vesta Petroleum Co. well No. "Palos Verdes" 1 and Silver Petroleum Co. well No. "Silver" 1 were completed as small producers at the southeastern end of Torrance oil field, Los Angeles County, California, which is known as the Torrance- Wilmington area. Previously Carson Oil Co. well No. 1 had been drilled and abandoned at a location about 600 feet southwest of "Palos Verdes" 1. This abandonment may or may not have been justified but a question arises as to the nature and extent of the discovery. In the latter part of 1938, Richfield Oil Corporation of California recognized the possibility of production from the zones equivalent to the Ranger and Terminal zones at Wilmington, and took means to protect them in its "Capitol" and "Spring" wells.

It is the writers' aim to analyze some pertinent conditions, both natural and mechanical in an effort to familiarize those interested with some of the questions that may arise during the future development of the area and its extension.

History

The Torrance oil field was discovered by C.C.M.O. Co. well No. "Del Amo" 1 in 1921. It was redrilled and completed at 3500 feet for 300 barrels per day, 21.6° A.P.I. oil, from lower Pliocene beds which are correlated with the Ranger zone of Wilmington. Rapid development followed and during the next few years the Torrance field was defined with the eastern producing limit at the General Petroleum Corp. of California "Poggi" lease. Various exploratory wells were located easterly and generally reported showings of oil. In 1932, Ranger Petroleum Co. well No. "Watson" 2 was completed as a 75 barrel per day producer of 13° A.P.I. oil, from a depth of 3786 feet in what is now recognized as the Wilmington field. While this may be regarded as the discovery



Vesta Petroleum Co.'s Palos Verdes No. 1.

well for the Ranger zone, it was not until General Petroleum Corp. of California well No. "Terminal" 1 was completed in December 1936, as a 1400-barrel producer, that a rapid development of Wilmington began. This hole was bottomed in schist at 6814 feet after testing several oil zones and was plugged back to 3625 feet where the well was completed in the Terminal zone. During the next year, General Petroleum Corp. of California well No. "Ford" 3 was completed in a zone about 1600 feet below the top of the Miocene, which was subsequently known as the Ford zone. With deep Miocene production established at Wilmington, the C.C.M.O. Co. at Torrance deepened its well No. "Del Amo" 34 and completed a 130 barrel per day pumper. Several other completions followed and soon the "boom" was on.

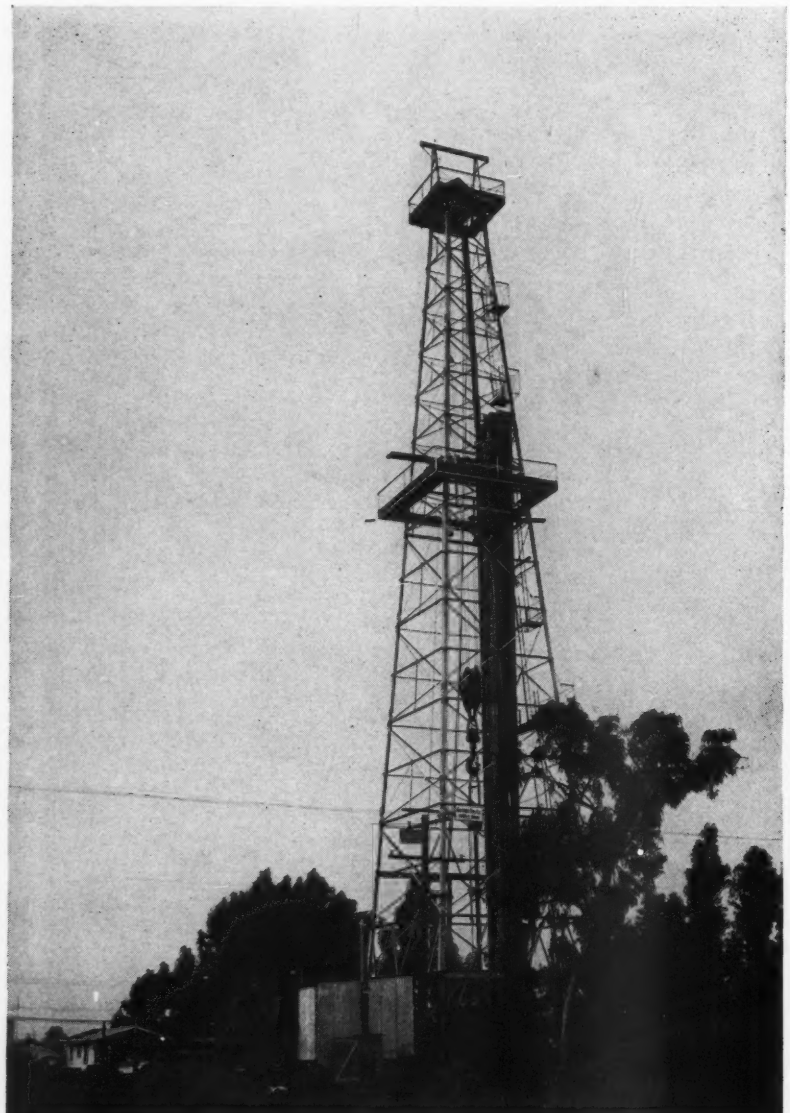
The deep Miocene development at Torrance proved the zone to be less than 200 feet thick and the production "spotty". Drilling was confined mostly to the Lomita and Eshelman areas.

The development of the Torrance-Wilmington area began with drilling of Carson Oil Co. well No. 1, located about 1100 feet southwesterly from the intersection of Figueroa and State Streets. This well, spudded in on June 30, 1937, was drilled to a depth slightly below 3949 feet encountering the Terminal zone at 3650 feet. Because of the usual difficulty and also because of the fact that there was some question as to the saturation of the sands in the Terminal zone, the well was abandoned in August 1937.

The first production in the Torrance-Wilmington area was the completion of D & B Oil Company well No. "Capitol" 1, located north and west of 253rd Street and Vermont Avenue, on June 21, 1938. At a total depth of 5275 feet and with an 8⅝ inch water string cemented at 5120 feet, the well flowed initially at a 450 barrel per day rate of 29° A.P.I. oil. The zone opened to production in this first well was the Ford zone equivalent at Wilmington.

Thereupon during 1938 and 1939, about 55 wells were drilled to the Ford zone in this area and completed as 250-500 barrel per day wells. Several wells were deepened to the basement complex, without finding additional production. These wells include R. R. Bush Oil Co. well No. "Torino" 1, D & B Oil Co. well No. "Dawn" 2, and The Texas Company well No. "Oakley" 2.

The completion of Vesta Petroleum Company well No. "Palos Verdes" 1 located about 500 feet south and just west of the intersection of Figueroa and State Streets, on March 14, 1940, was another step in the extension of this area. This well was originally drilled to a total depth of 3799 feet and a water shut-off effected at 3560 feet with 7-inch casing. To exclude the lower sands which appeared unsaturated, the hole was plugged with cement to 3710 feet and completed, producing less than 100 barrels per day of 17.8° A.P.I. oil. Believing that the small yield was largely due to mechanical difficulties, the hole was redrilled from 3610 to 3710 feet and



Acoma Oil Co.'s Well No. 1.

a gravel-pack liner landed at that depth. The well is now producing about 35 barrels per day.

The latest completion in the area is Silver Petroleum Co. well located about 1200 feet northeasterly from the intersection of State and Figueroa Streets. Drilled to a total depth of 3761 feet and with a combination water and gravel packed oil string cemented at 3560 feet, the well was placed on the pump on January 5, 1941, producing about 100 barrels per day of 19° A.P.I. oil.

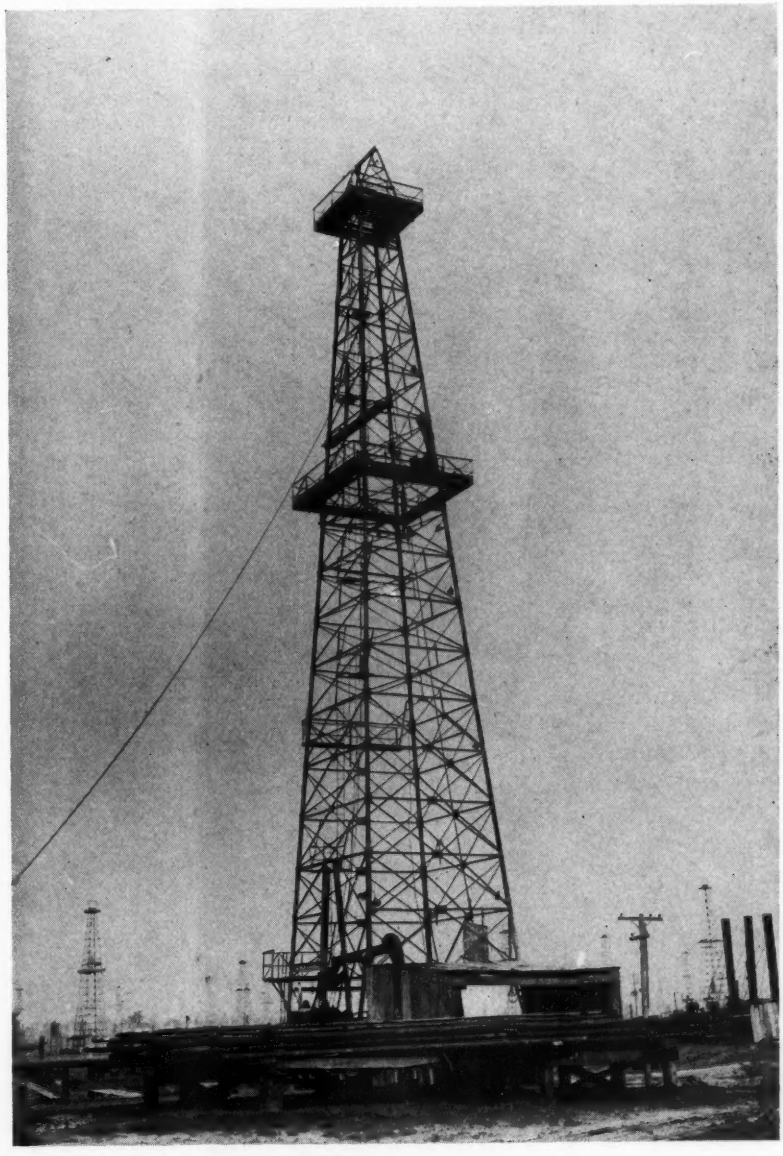
The only drilling well in the area at this time is Acoma Oil Co. well No. 1, located north and west of Robidoux and Frigate Streets. It is at present standing cemented with a combination water-oil string cemented at 3550 feet with gravel packed perforations between 3550 and 3762 feet, the total depth.

Geology

The surface beds in the Torrance-Wilmington area are regarded as Quaternary, the topography being accentuated by Bixby slough. This formation probably extends to about 600 feet and is underlain by Pliocene which includes the Saugus, Pico, and Repetto divisions, down to a depth of approximately 3300 feet. This in turn is underlain by the Upper Miocene which was found resting on the schist in well No. "Oakley" 2 at 6100 feet. In the Torrance field, the productive oil zones are found in the lower 400 feet of Pliocene which are probably correlatives with the Ranger zone at Wilmington. The deep zone, found about 1600 feet below the top of the Miocene, is thought to correlate with the Ford zone at Wilmington. These brief correlations are made for the sake of both convenience and simplicity in discussing this area.

The general structure of the Torrance-Wilmington area may be regarded as a saddle between the Torrance and Wilmington oil fields. Torrance field is a large anticline which plunges southeastward at the rate of about 150 feet per mile. The Wilmington structure is more nearly circular in shape and plunges northwestward at the rate of about 200 feet per mile. Their axes have been formed along the same line which shows a slight bend in the intervening area between the two fields. This differs from the general rule of the en-echelon structures along the Inglewood fault zone. Only one fault was recognized in the Torrance field during the early drilling, but recent development of the deep zone in 1937 has shown several faults parallel to the axis of the anticline. These faults had noticeable effect on accumulation.

At Wilmington there are a series of north-south normal faults downthrown on the east which cut the axis. These may be regarded as dividing the field into a series of blocks, each of which have somewhat different producing characteristics. This faulting is generally confined to the Miocene and Repetto beds, and does not continue to the surface from the Middle Pico formation. Production at Wilmington is regarded as coming from four zones, —the Tar and Ranger being confined to the lower 450 feet of Repetto; the upper and lower Terminal zones to the upper 1000 feet of Miocene; and



Silver Petroleum Co.'s No. 1.

CALIFORNIA
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Map of
TORRANCE–WILMINGTON
AREA
SUB-SEA CONTOURS ON TOP OF:
TERMINAL ZONE
KING & PRESTON - CONSULTANTS
3400
3450
3500
3525
3550
3575
3600
ANAHEIM
WILMINGTON
AVALON
MARINE
PACIFIC
FIGUEROA
R 13 W
R 14 W
SLOUGH
BIXBY
PESTA PT. OIL CO.
CARBON OIL CO.
THE TEXAS CO.
STANDARD OIL CO.
TIDEWATER ASSOC. OIL CO.
PACIFIC COAST OIL CO.
FOOTHILL OIL CO.
FOOTHILL OIL CO. (Operator)
FOOTHILL OIL CO. (Lessee)
TORRANCE OIL CO.
COASTLINE OIL CO.
FULLER OIL CO.
FULLER PAT.
ABRAMS-MALLEY
BARNHART-MORROW
SOMERSET OIL CO.
SOMERSET OIL CO. (Operator)
SOMERSET OIL CO. (Lessee)
PACIFIC COAST OIL CO. (Operator)
PACIFIC COAST OIL CO. (Lessee)
PACIFIC COAST OIL CO. (Spring)
PACIFIC COAST OIL CO. (Abdn.)
PACIFIC COAST OIL CO. (Prod.)
PACIFIC COAST OIL CO. (Inj.)
PACIFIC COAST OIL CO. (Drlg.)
PACIFIC COAST OIL CO. (Locn.)
PACIFIC COAST OIL CO. (Temp. Abdn.)
PACIFIC COAST OIL CO. (Susp.)
PACIFIC COAST OIL CO. (Water Supply)
PACIFIC COAST OIL CO. (Water Supply Abdn.)
PACIFIC COAST OIL CO. (Water Supply Susp.)
PACIFIC COAST OIL CO. (Water Supply Temp. Abdn.)
PACIFIC COAST OIL CO. (Water Supply Drlg.)
PACIFIC COAST OIL CO. (Water Supply Locn.)
PACIFIC COAST OIL CO. (Water Supply Prod.)
PACIFIC COAST OIL CO. (Water Supply Inj.)
PACIFIC COAST OIL CO. (Water Supply Lessee)
PACIFIC COAST OIL CO. (Water Supply Operator)
PACIFIC COAST OIL CO. (Water Supply Spring)
PACIFIC COAST OIL CO. (Water Supply Abdn.)
PACIFIC COAST OIL CO. (Water Supply Susp.)
PACIFIC COAST OIL CO. (Water Supply Temp. Abdn.)
PACIFIC COAST OIL CO. (Water Supply Drlg.)
PACIFIC COAST OIL CO. (Water Supply Locn.)
PACIFIC COAST OIL CO. (Water Supply Prod.)
PACIFIC COAST OIL CO. (Water Supply Inj.)
PACIFIC COAST OIL CO. (Water Supply Lessee)
PACIFIC COAST OIL CO. (Water Supply Operator)
PACIFIC COAST OIL CO. (Water Supply Spring)

the Ford zone from about 1600 feet below the top of the Miocene. These zones produce various amounts and gravities of oil within the different blocks. While the Ranger zone is productive over most of the Wilmington field, this does not follow for the other zones.

In the Torrance-Wilmington area, the Vesta and Silver wells are producing from the upper part of the Miocene; which is the Upper Terminal equivalent at Wilmington. While none of the wells in the area have opened the lower Ranger zone to production, it should be found productive at favorable locations. Certain faulting parallel to the axial trend was noted in the central part of the "Poggi" lease, as well as a north-south component a slight distance west. Similar faulting may be expected in the easterly extension of the area, especially in Miocene beds because of the nearness of the Palos Verdes upthrust block. It is thought that all or part of the Pliocene beds may be draped over a fault pattern, thus giving rise to a number of small folds upon or adjacent to the major structural trend. Undoubtedly the newly developed production from the Terminal zone is the result of such phenomena.

What of Future Development?

Now that economic production from the Terminal zone has been found in the Torrance-Wilmington area, it is only natural to inquire if it will connect with the production in the zones at Wilmington. The accompanying map shows our idea of the structure at the present time.

The presence of a fold rising easterly toward Wilmington seems to us to indicate that it will connect with the main Wilmington field. Intervening faulting may be expected with good production possibilities in the Lower Ranger and Ford zones at favorable locations.

The entire story for this area is not yet known, but future development, whether it is a field extension or a search for new productive areas, should include the following considerations:

1. Structure and sedimentation of the area.
2. Correlation with nearby development, which is generally done with electric logs and paleontological evidence.
3. Determination of productive possibilities by core analysis and formation tests.
4. Completion methods adequate but within the economic range indicated from the ultimate oil recovery.

The above needs no amplification as the operators who are exploring or developing minor structures are constantly faced with the question: How much oil will the wells produce and what will be the return on the investment?

Election of Officers of Youngstown Steel Products

The board of directors of The Youngstown Steel Products Co. of California announces the election of the following officers: J. A. Crawford, president; J. W. Schmid, vice president, and L. B. Wiggins, treasurer.

March Production Set at 571,000 Bbls. Daily

The Conservation Committee of California Oil Producers recommended a March oil production quota of not to exceed 571,500 bbls. daily at its meeting Feb. 20, the same as the recommendation for the current month. Additional curtailment of individual wells, however, will be necessary, since the additional production from new wells will be greater than reduction from abandonments and suspensions of old wells.

In view of the approach of the end of the Committee's fiscal year, A. H. Bell, chairman, appointed an Elections Subcommittee of H. S. Stark, chairman; V. H. Wilhelm, Richard Fenton, F. M. Zeigler, Quay Diven, E. Robert Burns and Laurence Kelly. This committee will handle all details of the annual election of field committee members, the chairmen and vice chairmen of which become members and alternates, respectively, of the Conservation Committee.

Discussion on the floor, led by Joseph Jensen, of the Tide Water Associated Oil Co., brought out the fact that during the past two years there has been a gradually increasing lack of balance in production of light and heavy oil, the result being that while storage of lighter oils has been practically constant, heavy oil storage has decreased by approximately 16,000,000 bbls. during the period. Mr. Jensen expressed the opinion that the lack of balance would soon be acute, and after further discussion, the committee instructed its allocation committee to make a study of the problem and report back at the next meeting.

Paloma Turned Down

A request of operators in the Paloma District, that they be allowed an overproduction during a subsequent six-month period equal to their present underproduction resulting from delay of operation until a unit and gas recycling plan can be worked out, was turned down by the allocation committee, the action being confirmed by the main committee. While it was admitted that the Paloma operators were proceeding along a highly commendable course, the committee decided that to allow the making up of underages by subsequent overages would establish a dangerous precedent.

The Committee estimates that 86 wells will have been completed by the end of February and will require a March allotment of 7,972 bbls. per day. In addition, reconditioned and recompleted wells will require an allotment of 225 barrels per day, making a total of 8,197 bbls. of new daily allotment. To offset that figure, natural decline, suspensions and abandonments of present producing wells will total only 4,500 bbls., leaving 3,697 bbls. to be subtracted from daily production rates by modifications in the uniform curtailment formula.

These modifications are: two barrels per day off the top allotment, bringing it down to 145 bbls., and a reduction of the power factor applied to intermediate wells to result in curtailment of 2,400 bbls. per day. The total of all reductions, including natural decline, suspensions, and abandonments, is 8,892 bbls. per day, bringing the preliminary March allotment to 571,085 bbls. per day for the State.

Continental Completes San Miguelito Project

With an initial of 450 bbls. a day, Continental Oil Co. brought in its Grubb No. 21 at San Miguelito from a depth of 6884 ft. Gas production was estimated at 3,000,000 cu. ft. Perforated intervals in the liner totaled 1235 ft. below the water string shoe at 5460 ft.

Texas Co. Finishes Shiells Canyon Well

Bottoming at 4100 ft., The Texas Co. brought in Shiells No. 140 at Shiells Canyon pumping 65 bbls. a day of 36.5 gravity clean oil. No other wells are active in the field at present.

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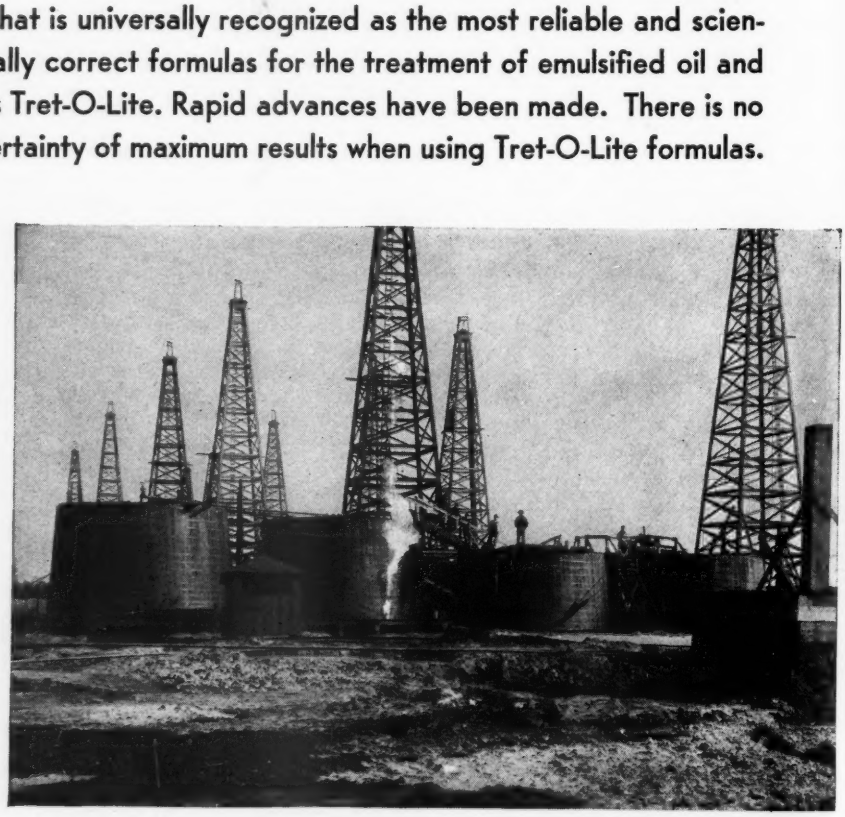


Oil settling tank, West Columbia oil field, 1919.

Review of 1940 California Development

In the Petroleum Industry

By V. H. WILHELM, Member A.I.M.M.E.

Since 1935 California has enjoyed a remarkable cycle of discovery which has placed the State in a very satisfactory position in regard to oil reserves. At the present time most of the geophysical plays have been drilled and it is possible that new discoveries must be made by the application of careful geologic and stratigraphic studies.

During 1940 only one new field was discovered. Although this field is not of major importance, it may lead to additional discoveries. 113 wildcats were drilled with one discovery.

New discoveries, extensions and a reappraisal of discoveries made in 1939 will not approximate over 50,000,000 barrels, as against an estimated withdrawal during the year of 224,000,000 barrels.

Demand in terms of crude for 1940 was 632,000 bbls. daily as against 626,000 bbls. daily for 1939. Demand for gasoline was the same as 1939, but the demand for fuel oil increased 3.8 per cent. Compared with 1939, Japanese shipments decreased from 75,786 bbls. daily to 61,000 bbls. daily, but the balance of Pacific foreign shipments increased from 59,409 bbls. daily to 61,304 bbls. daily. Total withdrawals from storage during the year will approximate 7,002,000 barrels, practically all of which is fuel oil.

Drilling activity was slightly greater than in 1939 and accounted for 890 new producing wells as against 851 for 1939. (See table)

Production averaged 611,697 bbls. daily as compared with 614,668 bbls. daily for 1939.

The productive acreage figure of the State was increased by 4,000 through discoveries and extensions.

New Discoveries
Los Angeles Basin District

Del Valle Field

Northwest of Newhall, where the first oil well in California was drilled, R. E. Havenstrite completed his Lincoln No. 1 well, flowing 390 barrels of 50° gravity oil together with 7,000 MCF of gas. The well was later recompleted, after cutting off the gas, for 950 barrels of 34° gravity oil. The type of structure from which this production is coming is a plunging anticline, complicated by faulting. The Lincoln No. 1 well uncovered approximately 180 feet of net sand. This field contains a gas cap and its indicated productive area approximates 500 acres.

The district in the vicinity of the Del Valle Field is expected to have an intensive wildcat drilling campaign during this coming year.

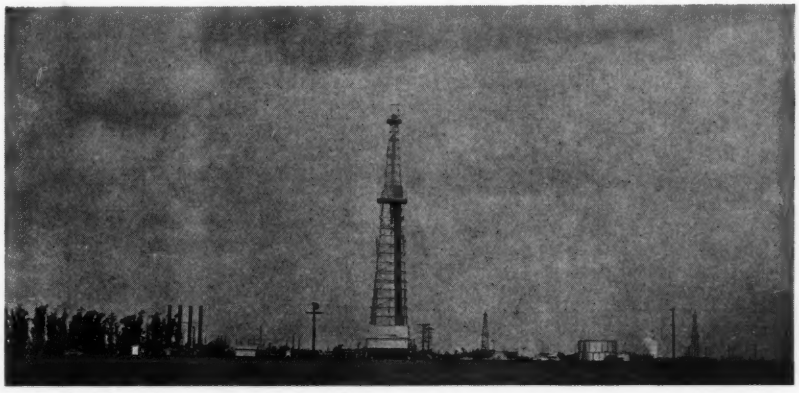
Extensions and Deeper Sand Developments
Los Angeles Basin District

Athens Field

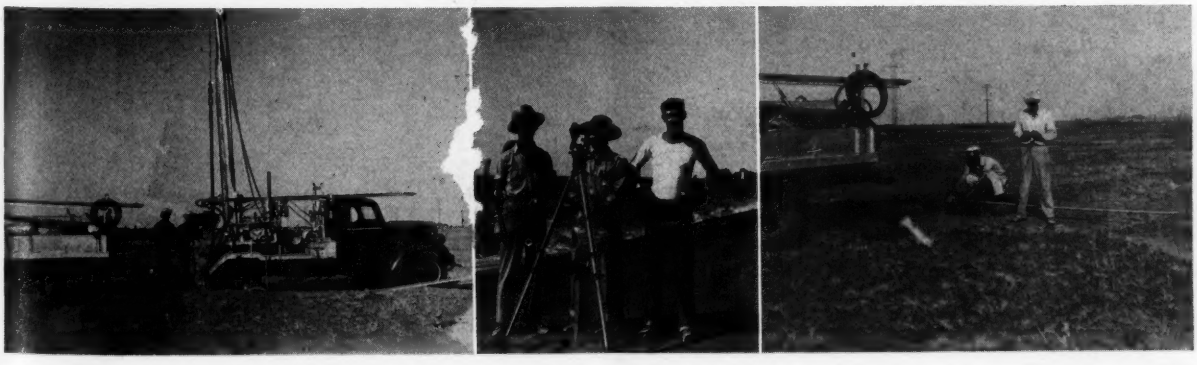
On the northwest plunge of the Athens structure, the Thorley Oil Company completed its No. 12-1 well, flowing 250 barrels of 32° gravity oil from a depth of 8097 ft. The area in which the well is located is complicated by faulting and it is impossible at this date to determine the importance of this deep zone discovery.

Inglewood Field

The Bush Oil Company discovered a new deep middle Miocene zone in the Inglewood field by completing its Sentous No. 1 well on the west flank of the field for 150 barrels of 32 gravity oil from a depth of 8760 ft. The well is located on the edge of the structure and indications are that the substantial production from this zone will be obtained at higher structural positions. The producing zone in the Bush well is considered equivalent to Topango, Middle



Union Oil Co.'s Callender No. 79 at Dominguez continues the deepest mystery in the Basin.



Left: Luther Barker and W. L. Palone, one of General Geophysical Co.'s drilling crews. Center: Superior's Survey crew in Rio Bravo—Sim Dunham, Ray Kelseh and Jack Lacey. Right: Ollis Gribble and Herb Evans, powder crew for General Geophysical Company.

Miocene, which is the first known production from this formation in the Los Angeles Basin.

Deep drilling on the Inglewood structure shows that the fold is very asymmetrical at depth, with a steeply dipping east flank.

Rosecrans Field

On the southeast plunge of this field, an additional fault line extension was discovered, yielding 1500-barrel wells of 32 gravity oil from the Miocene beds. This discovery has expanded the limits of the field by about 50 acres.

Wilmington Field

This field was the most active in the State, completions for the year amounting to 158. A considerable area remains undeveloped and indications are that this year will see development in proportion to that of 1940.

An extension of this field to the northwest indicates that the Torrance and Wilmington fields will be contiguous.

San Joaquin Valley District

Coles Levee and Richfield Western Fields

Fifty-eight wells were completed in these two fields during 1940. The area comprising these fields was the second most active area in the State. Development to date shows that the Coles Levee and Richfield Western fields are separate structures. The Coles Levee field is an overlap accumulation with a proved acreage of about 2,915 acres, while the Richfield Western field is an anticline with approximately 1,730 proved acres.

Midway-Sunset Field

The Republic Petroleum Company discovered a small closed structure in the Santa Margarita shale, west of Taft, by the completion of its No. 1 well. This well was brought in on the pump for 165 barrels of 17.5° gravity oil from a depth of 1887 ft., producing from about sixty feet of net sand. The productive area of this accumulation is estimated at eighty acres.

Paloma Field

This field, discovered in 1939, now has five producing wells. Data which have recently been developed indicate a large productive area and is the first distillate field in California to be recognized as such in advance of developments.

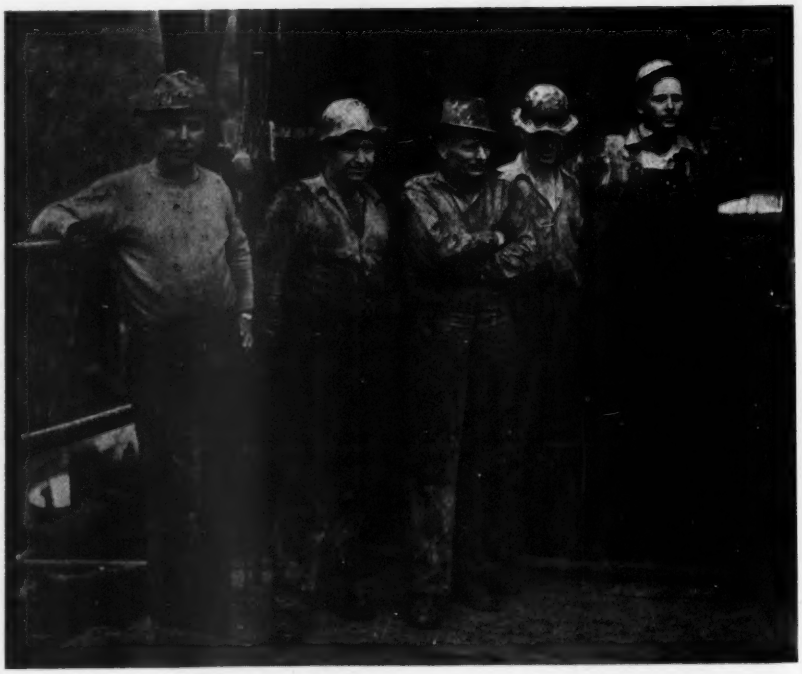
If an agreement between all operators in this field can be concluded, the gas will be recycled in order to obtain the greatest ultimate recovery.

Curtailment

Voluntary curtailment continued to be effective and although production was generally above the State quota the average was well below the State market demand, as evidenced by the decrease in total stocks. During the year the top allotment to new wells was decreased from 195 barrels per day in January, 1940, to 148 barrels per day in January, 1941, a drop of forty-seven barrels per day in twelve months. During the same period the State quota set by the Conservation Committee of California Oil Producers decreased from 594,000 bbls. daily to 570,000 bbls. daily.

New completions during 1941 will require approximately 80,000 barrels of new

This Drilling and Exploration crew is setting a drilling record in Ventura on Lloyd Corp.'s Lloyd No. 7. Left to right they are: J. Siler, M. W. Essex, J. Surber, Robert Taylor, H. C. Tolbert.



Drilling Hartmann No. 11 for British American in Ventura Avenue is this Taft Oil Well Drilling crew. Left to right are John Alexander, W. F. Miller, E. W. McClellan, S. A. Wells and Mark York.

allotment. Decline, suspensions, and abandonments will average 5,000 barrels a month or 60,000 barrels of allotment during the year. Therefore the 938 top wells and the 8,000 intermediate wells must be declined to make room for this 20,000 barrels of new allotment, unless conditions warrant an increase in the State quota of 570,000 barrels. If this is done, the top allotment probably will not be decreased below the present allotment of 148 barrels per day.

Advances in Drilling and Production Practices

The past year showed a continuation of recent year trends in drilling and producing equipment and methods, chiefly the closer application of engineering principles toward individual jobs rather than the system of the past of applying the same method to all types of drilling. Outstanding has been the reduction of cost and drilling time in deep wells by means of engineering analysis of performance data and records of drilling aids, such as gauges of table speed, drilling weight, pump speed, mud properties, etc.

The cost of drilling shallow marginal wells has been cut sharply by the use of portable and semi-portable gas engine driven drilling machinery. Whenever the market for oil becomes stronger it is probable that a considerable number of shallow wells of this type may be drilled in some of the older fields.

Producing methods have followed the same trend as drilling, that is, application of engineering to individual problems. Larger volumes of oil from deep wells are being pumped with equipment of conventional type. A means of pumping new marginal wells cheaply is still urgently needed since the cost of satisfactory pumping equipment is excessive as compared with the new lower drilling costs.

Conclusion

Pacific shipments will probably be decreased approximately 20,000 barrels per day, due to additional shipments to Japan from the Dutch East Indies. Readjustment of Pacific markets will compensate to some extent for loss of Japanese shipments.

Increased industrial activity will tend to raise domestic demand sufficiently to make up for loss in Pacific shipments. Total demand for petroleum products in the Pacific Coast area should therefore be normal in 1941.

Wildcat mortality in California continued to be high and will tend to rise as the potentially productive area is reduced. In contrast with previous years the discoveries and extensions during 1940 were mainly in the Los Angeles Basin.

CALIFORNIA OILFIELD DEVELOPMENT TABLE

Year	Number Drilling Notices Filed	Number Drilling Wells Abandoned	Number Producers Abandoned	Number Producers Completed (New Wells)	Percentage of Increase or *Decrease	Initial Production of New Wells, Daily Average, Bbl.	
						Per Well	Total
1930	918	254	320	755	*17	775	584,521
1931	329	238	177	246	*67	1,481	364,434
1932	279	191	172	184	*25	852	156,823
1933	596	163	215	248	35	1,105	274,104
1934	631	247	200	449	81	1,190	534,508
1935	986	347	203	710	37	954	677,320
1936	1,102	320	208	786	11	471	370,227
1937	1,643	313	273	1,156	47	560	647,331
1938	1,162	265	252	994	*14	1,242	1,234,482
1939	1,174	251	274	851	*14	1,314	1,118,102
1940	1,040	172	336	890	5	1,428	1,270,756

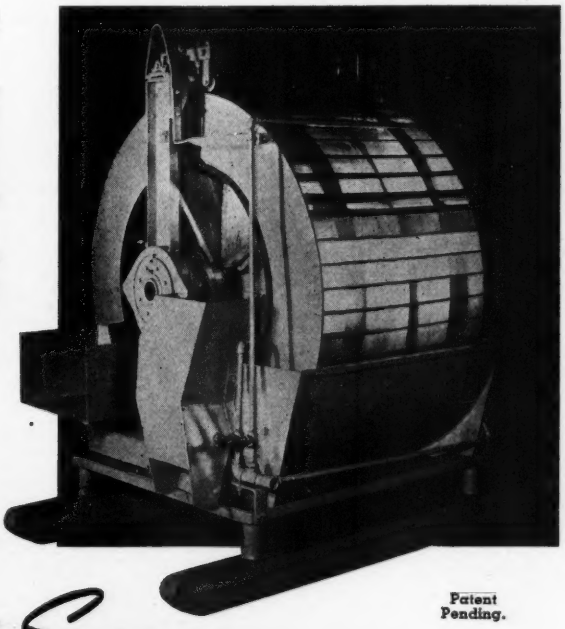
*—Decrease.

THE PROVEN METHOD OF POSITIVE SAND AND SHALE ELIMINATION

Sandalyzer

ROTATING VIBRATING MUD SCREEN

REALLY SAVES MONEY



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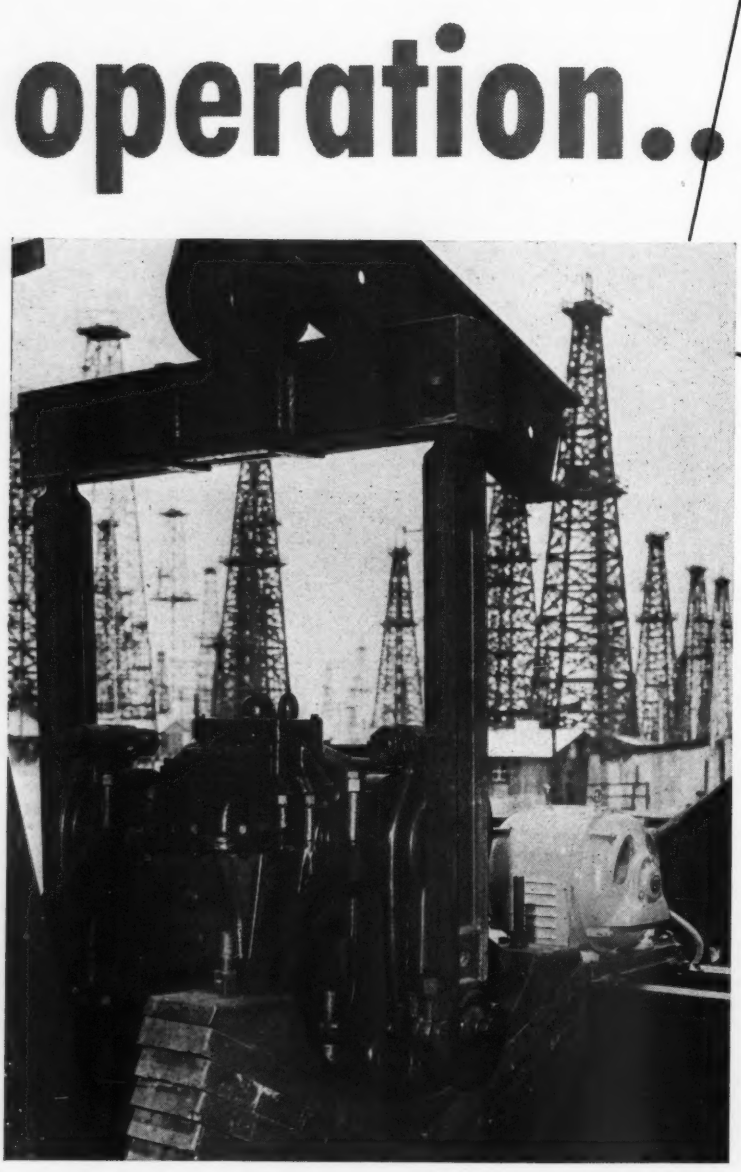


An electric pumping unit prevents trouble, worry and expense in four ways: It is easy to start in any weather. It requires no attention while in operation. Its smooth, even action is easier on the sucker rod and pump than the variable power supplied by other types of units. It seldom requires repairs even after ten, twelve, or even more years of service, and, when repairs are necessary, they are comparatively easy and inexpensive to make. You may be surprised to learn that trouble-free electric pumping costs less than other methods, but it's a fact. Call your Edison office for the figures.

SOUTHERN CALIFORNIA

ALL-WINTER SUN FESTIVAL

★ ★ ★

This 10 horsepower electric motor in the Signal Hill field provides trouble-free pumping at lowest possible cost.

ELECTRIC PUMPING IS BETTER AND COSTS LESS

Edison

High Lights of Petroleum Industry—Peru

Chile, Argentina and Brazil

By Luis C. Chappuis
Geologist and Petroleum Engineer,
Los Angeles

A native of Peru, Mr. Chappuis graduated in Geology from University of California at Berkeley since which time he has followed his profession continuously both as an independent consultant and in the employ of a major company. He has made frequent professional trips to South America and has just returned from a comprehensive tour of the continent.

Of all the South American countries, Peru is recognized as the oldest producer of petroleum, and up to 1924 was the largest producer in South America. The world's production in that year amounted to 1,061,900,000 barrels, of which Peru produced 5,698,509 barrels, placing that country eighth among producing countries of the world.

Drilling is known to date back to 1865, when the first wells were drilled at Zorritos. In 1870 the district known as Negritos was discovered. These two fields were destroyed by the Chileans in 1879-1883, during the war between Peru and Chile.

Peru in 1930 occupied ninth place in the world's production of petroleum and produced 12,108,875 barrels or 0.9% of the world's output. In 1940 the production amounted to 15,830,000 barrels and occupied 12th place in the world's production. The reason Peru has dropped to 12th place, from eighth place in 1924, is due to the fact that Venezuela and Colombia have made fast strides in the development of their petroleum resources.

The quality of the crude petroleum produced in Peru has an average gravity of 37 A.P.I. It has a mixed base (asphaltum and paraffin) and a very low sulphur content, and yields from 30 to 44% gasoline without cracking.

To date only the northern coastal region of Peru is being exploited. The possibilities of new discoveries in the Southern coastal region so far have been overlooked, but in the near future, this large expanse of unfertile waste lands will be looked upon very favorably and exploratory work, either by the Peruvian Government or foreign companies undoubtedly will be undertaken.

The climatic conditions, linked with transportation facilities, both by land and sea are factors that will facilitate the future development of Peru's large oil resources.

Chile

To date no petroleum has been discovered in this nation. The only area of Chile offering such possibilities is the region around the straits of Magellan. In the past, several exploratory test wells were sunk and it was reported that good showings of oil and gas were found. The present Government has appropriated the necessary funds to have a complete geological survey made of this region for the sole purpose of finding out whether or not, such possibilities do exist.

At the present time there are two oil refineries in operation. The crude petroleum for these operations is imported from Eucador and Peru. The markets for refined petroleum products in this nation are very limited.

Fuel, diesel oil and lubricants are imported from the United States.

Argentina

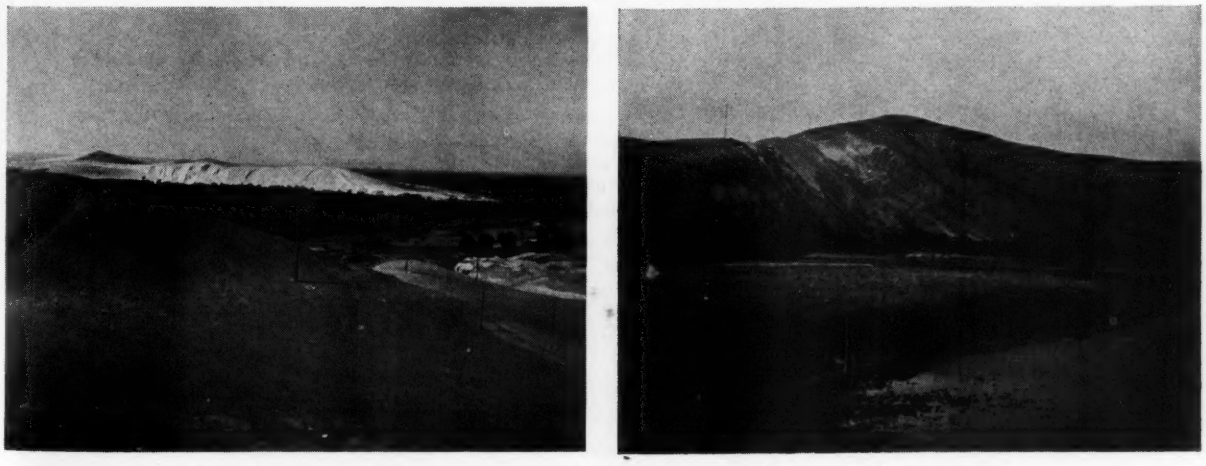
There is very little to be said about the oil industry of this nation. "Y.P.F."—"Yacimientos Petroliferos Fiscales," a governmental agency, will in due time replace the foreign oil companies still operating in Argentina. It is the opinion of the Y.P.F., that within the next two years the production from the fields which they are operating, will be ample to supply the nation's requirements, and at such time all foreign companies will be forced to retire from the country, and no imports from foreign countries will be needed.

Brazil

For many years Brazil has been searching for petroleum. Exploratory work has been undertaken without success in the northeastern portion of the nation and along the boundaries between Peru, Bolivia and Brazil. Recently in the state of Bahia (Northern Brazil) Brazilian wildcatting was somewhat successful in this area. Two shallow wells (1200 and 1230 feet deep) have been completed for an average daily production of 45 barrels per well. The daily production as of October 1940, was in the neighborhood of 125 barrels daily.

This exploratory work is being done by the Government under the "Consejo Nacional de Petroleos." This national council of petroleum is planning the installation of a refinery in the very near future. In the year 1938 Brazil passed a law having strictly nationalistic tendencies. This law will undoubtedly place the oil industry in the hands of a few politicians.

My personal opinion is that a situation of this kind will be of short duration, provided the technical and practical men employed to do this exploratory work,

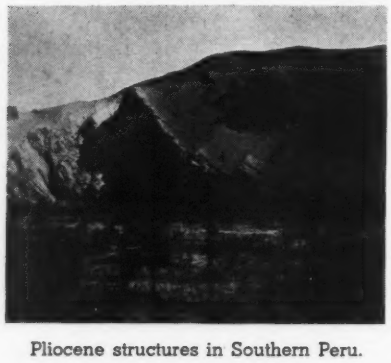


Left: Miocene structures in Southern Peru. Right: Pliocene structures in Southern Peru.

Y. P. F. gasoline pump in Buenos Aires.

are imported from the United States. At the present time 90% of the oil field equipment in use in South American oil fields, is imported from the United States and with continuity of the European situation, the American manufacturers of oil well supplies should enjoy a healthy business.

My advice to manufacturers who are contemplating sending their representatives to these Latin American countries,



Pliocene structures in Southern Peru.

is that they should select technical men, well versed on the product they are selling. They should speak the Spanish language and above all, they should be of the refined and somewhat diplomatic type. The type of salesman that walks into, or is admitted inside an executive's office, with a pocket full of five cent cigars and pushes one down his prospect's throat, should remain at home to take a few lessons in Latin-American etiquette.

Standard Building Huge Houdry Plant

Plans have been completed by the Standard Oil Co. of California for the construction of a Houdry Catalytic cracking and Reforming Plant at its El Segundo refinery in Southern California. Equipment for this important installation, which will contribute to national defense through providing a greater volume of high octane aviation gasoline, is now being ordered. It is anticipated that the plant will be in operation early next year. The cost will be in excess of $4,500,000.

The Houdry Catalytic Process is one of the most notable scientific advancements for the manufacture of gasolines of recent years. It is the invention of M. Eugene Houdry, French engineer and scientist, who came to the United States and enlisted support in the development of his revolutionary process. Two years ago, shortly after license to use this method of refining was made available, this company was the first western refiner to take over the process. Since that time laboratory and semi-commercial scale operations have been under way. The result of this intensive period of research is the company's decision now to build the only Houdry Catalytic Cracking and Reforming Plant on the Pacific Coast.

With the completion of this installation, a new high octane catalytic motor gasoline, outstandingly different from any fuel now produced on the coast, will be made from California crude oil, according to Standard engineers. The plant will also increase the company's production of high octane aviation gasoline to an important extent. This additional output comes at a propitious time to assist materially in meeting the increased demands of the army and navy for high octane aviation gasoline.

50,000 KVA

OF SHORT-CIRCUIT PROTECTION

RIGHT IN THE MOTOR STARTER

HERE'S PLUS VALUE IN A G-E OIL-IMMERSED HIGH-VOLTAGE STARTER

IT ALSO PROVIDES

1. Resistance to corrosion
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3. Undervoltage protection

ENOUGH capacity to interrupt a three-phase short circuit of 50,000 kva—that's what you get in this G-E starter.

It doesn't require additional fault-current protection for itself or the motor it controls. Furthermore, you can depend on it to resist the mechanical stresses that a short circuit on the line may set up.

All operating parts of this starter are completely immersed in oil for resistance to corrosive atmospheres. The highly efficient, isothermic, induction-temperature overload relay, which provides overload protection, is also immersed in oil. The magnetic time-delay undervoltage trip prevents unnecessary shutdowns and unexpected restarting after a power failure.

Two forms are available: the lift-out-of-tank type and the framework-mounted, tank-lowering type.

Our nearest Western representative will be glad to discuss the application of this control with you. Contact him TODAY.

GENERAL ELECTRIC CO., SCHENECTADY, N. Y.

GENERAL ELECTRIC

Production « « » » Development

(Figures of Production and Stocks are in barrels of 42 Gals.)

	Total Production December	—DAILY AVERAGE— Dec., 1940	Nov., 1940	Dec., 1939
Group No. 1				
Arvin	32,655	1,053	1,225	2,389
Belridge—North	302,227	9,749	9 837	11,785
Belridge—South	66,541	2,146	2,107	1,142
Canal	160,799	5,187	5,189	5,922
Canfield Ranch	1,335	43	38	68
Coalinga	1,026,529	33,114	31,561	21,214
Cole's Levee	147,437	4,756	4,171	1,854
Edison	87,053	2,808	2,998	2,216
Elk Hills	373,786	12,058	12,157	12,166
Fruitvale	164,969	5,322	5,385	6,140
Greeley	154,285	4,977	4,671	2,878
Kern River	320,714	10,345	10,759	11,527
Kettleman No. Dome	1,206,608	38,923	38,992	52,287
Lost Hills	107,494	3,468	3,400	3,361
McKittrick	111,028	3,582	3,509	3,551
Midway-Sunset	1,482,206	47,813	47,453	50,769
Mountain View	184,401	5,948	6,149	7,277
Mount Poso	272,404	8,787	8,832	10,755
Paloma	12,730	411	640	174
Rio Bravo	328,233	10,588	10,038	7,974
Round Mountain	234,771	7,573	7,521	8,035
Strand	42,741	1,379	1,398	1,159
Ten Section	349,055	11,260	11,028	8,328
Tupman	203,773	6,573	6,796	1,029
Wasco	51,232	1,653	1,844	1,115
Wheeler Ridge	9,328	301	300	329
Group No. 2				
Capitan	53,236	1,717	1,698	2,082
Elwood	98,395	3,174	3,236	4.039
Rincon	148,883	4,803	4,973	4,019
San Miguelito	105,039	3,388	3,359	2,930
Santa Barbara	5,746	185	215	268
Santa Maria	249,919	8,062	6,896	3,603
Santa Maria Valley	518,668	16,731	19,097	11,195
Summerland	492	16	17	27
Ventura Avenue	1,042,213	33,620	33,649	36,418
Ventura-Newhall	290,359	9,367	9,338	6,789
Watsonville	775	25	25	30
Group No. 3				
Brea-Olinda	170,938	5,514	5,533	5,540
Coyote—East	120,321	3,883	4,072	2,900
Coyote—West	275,180	8,877	8,838	6,232
Domingues	626,480	20,209	21,795	18,901
El Segundo	49,533	1,598	1,810	2,782
Huntington Beach	808,308	26,074	25,607	27,921
Inglewood	345,173	11,134	11,139	13,067
Lawndale	1,045	33	32	46
Long Beach	1,295,010	41,774	42,283	44,334
Los Angeles-Salt Lake	16,015	517	520	520
Montebello	495,494	15,984	16,419	27,093
Playa Del Rey	110,574	3,567	3,985	4,494
Potrero	66,154	2,134	2,191	1,301
Richfield	233,449	7,531	7,432	8,639
Rosecrans	384,537	12,404	13,203	10,004
Santa Fe Springs	775,852	25,027	25,324	26,039
Seal Beach	205,805	6,639	6,618	6,965
Torrance	293,154	9,457	9,728	13,165
Whittier	6,640	214	185	1,006
Wilmington	2,506,174	80,844	80,478	85,001
Total	18,733,895	604,319	607,693	612,794
November	18,230,804	607,693		
Decrease (*Increase)	503,091*	3,374		

	New Rigs Up	Producers Active Drilling	Com-pleted	Daily Initial Output	Active Pro-ducing	Abandoned Wells Drillers	Pro-ducers
Group No. 1							
Arvin	..	....	....	....	15	....	....
Belridge—North	..	3	2	525	73	....	....
Belridge—South	..	....	....	....	189	....	....
Canal	..	....	1	300	35	....	....
Canfield Ranch	..	....	....	....	1	....	....
Coalinga	2	18	7	9,869	907	1	....
Cole's Levee	2	5	3	1,755	34	....	....
Edison	..	....	....	....	97	....	....
Elk Hills	..	1	....	....	197	....	....
Fruitvale	..	....	....	....	171	....	....
Greeley	2	6	1	3,370	38	....	....
Kern River	1	3	1	13	1,551	....	....
Kettleman North Dome	..	5	4	2,399	268	....	....
Lost Hills	..	....	1	15	265	....	....
McKittrick	1	....	....	....	198	....	....
Midway-Sunset	..	4	1	450	2,506	....	4
Mountain View	..	....	....	....	175	....	....
Mount Poso	1	1	....	....	285	....	....
Paloma	..	2	....	....	5	....	....
Rio Bravo	1	5	3	3,856	72	....	....
Round Mountain	..	....	....	....	223	....	2
Strand	..	1	....	....	8	....	....
Ten Section	4	3	4	7,093	71	....	....
Tupman	1	8	3	3,499	42	....	....
Wasco	..	1	....	....	12	1	....
Wheeler Ridge	..	1	....	....	34	....	....
Group No. 2							
Capitan	..	....	....	....	44	....	....
Elwood	..	....	....	....	74	....	....
Rincon	1	1	1	125	69	....	....
San Miguelito	2	3	....	....	27	....	....
Santa Barbara	1	1	1	25	20	....	....
Santa Maria	..	....	....	....	181	....	....
Santa Maria Valley	2	2	1	150	142	....	....
Summerland	..	....	....	....	8	....	1
Ventura Avenue	2	6	6	7,038	328	....	....
Ventura-Newhall	4	11	2	476	522	....	....
Watsonville	..	....	....	....	7	....	....
Group No. 3							
Brea-Olinda	1	1	....	....	362	....	....
Coyote—East	1	3	....	....	85	....	1
Coyote—West	..	....	....	....	78	....	....
Domingues	2	6	....	....	200	....	....
El Segundo	..	....	....	....	39	....	....
Huntington Beach	3	3	5	2,318	551	....	2
Inglewood	..	2	2	2,593	200	....	....
Lawndale	..	....	....	....	3	....	2
Long Beach	3	3	2	320	1,215	....	2
Los Angeles-Salt Lake	..	....	....	....	101	....	2
Montebello	1	1	....	....	331	....	2
Playa Del Rey	..	....	....	....	146	....	....
Potrero	..	1	1	200	20	....	....
Richfield	..	....	....	....	297	....	....
Rosecrans	..	7	1	170	171	....	....
Santa Fe Springs	1	....	....	....	582	....	1
Seal Beach	1	2	....	....	120	....	....
Torrance	..	....	....	....	632	....	5
Whittier	..	....	....	....	38	....	....
Wilmington	16	15	10	3,797	910	....	....
Miscellaneous Drilling	6	35	....	....	....	....	....
Group No. 4—Gas Fields							
Buena Vista Lake	..	....	....	....	3	....	....
Buttonwillow	..	....	....	....	23	....	2
Chowchilla	..	....	....	....	....	....	....
Delano	..	....	1	Gas	21	....	....
Fairfield Knolls	..	....	....	....	....	....	....
Goleta	..	....	....	....	....	....	....
Marysville Buttes	..	....	....	....	3	....	....
McDonald Island	..	....	....	....	5	....	....
Rio Vista	..	....	....	....	23	....	....
Semi-Tropic	..	....	....	....	2	....	....
Tracy	..	....	....	....	4	....	....
December	62	170	64	50,356	15,059	2	26
November	74	180	59	43,600	15,005	11	24
Increase (*Decrease)	12*	10*	5	6,756	54	9*	2
Average for year 1940	84	179	73	63,775	15,013	13	28

SUMMARY OF CALIFORNIA OILFIELD OPERATIONS FOR DECEMBE R 1940—STOCKS HELD IN PACIFIC COAST TERRITORY BY CALIFORNIA OIL COMPANIES

	Dec. 31, 1940	Nov. 30, 1940	December Changes	Dec. 31, 1939
1. Gasoline-Bearing Crude	35,914,258	35,040,846	+ 873,412	35,136,501
2. Non-Gasoline-Bearing Crude	11,872,989	12,238,745	− 365,756	13,303,091
3. Unblended Nat. Gas	2,485,779	2,548,369	− 62,590	1,516,033
4. Gasoline (not including distributing and service stations)	14,864,355	14,619,376	+ 244,979	16,128,052
5. Naphtha Distillates	1,889,913[1]	1,794,281[1]	+ 95,632	1,282,484[1]
6. Gas Oil and Diesel Oil	10,160,780	10,142,821	+ 17,959	9,671,299
7. Fuel Oil Residuum	59,920,167	60,903,241	− 983,074	66,886,434
8. All Other Stocks	8,458,283[2]	8,501,975[2]	− 43,692	8,011,354[2]
TOTAL	145,566,524	145,789,654	− 223,130	151,935,248
[1]Estimated amount of unfinished gas. contained in item5	1,711,171	1,654,924		1,032,536
[2]Coke included in item 8	914,273	971,106		976,545

Two More **POLYFORM-GAS REVERSION UNITS**

by **LUMMUS**

Lummus is designing and building two Polyform-Gas Reversion units—one, 4600 barrels per day and the other, 7300 barrels per day of naphtha and outside propanes and butanes.

These are the thirteenth and fourteenth Polyform-Gas Reversion plants—including four now under construction by Lummus—with a total fresh feed charge of 67,000 barrels of naphtha, propanes and butanes.

Write for complete data on Polyform and Gas Reversion processes.

THE LUMMUS COMPANY, 420 Lexington Avenue, NEW YORK, N. Y.

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LUMMUS

PETROLEUM REFINING PLANTS

The Role of Multicolumn Fractionation

In the Natural Gasoline Industry

CNGA Meeting
February, 1941

By F. D. Parker, Union Oil Co. of California

This paper discusses the role that multicolumn fractionation plays in the preparation of essentially pure components, or narrow boiling cuts, from natural gasoline. By multicolumn fractionation is meant the separation by distillation of components or cuts in a series of fractionating towers so integrated in operation that one or all of the products from one tower comprises the feed or feeds to other towers in the series.

The reasons why multicolumn fractionating is significant at this time are basically three:

1. The market for liquid petroleum gases, both propane and butane, is expanding, and this requires the production of these products in maximum quantity and of satisfactory quality from natural gasoline stabilization.

2. The growth of the alkylation process has brought about a demand for isobutane which is used in the process. As a rule alkylation plants are located at major refineries where considerable cracking is done inasmuch as olefins are required for the process, whereas natural gasoline is produced and stabilized to a considerable extent in the field. This demands that isobutane be produced both in considerable quantity and of high quality to avoid shipping costs on relatively worthless inert fractions.

Another component which is gaining use in the production of high octane aviation fuels is isopentane, and by the same token as for isobutane above this must be produced in considerable quantity and of high quality.

3. This segregation of individual components of the lighter fractions of wild natural gasoline, principally propane and butane, is a requirement of certain processes now developed. In these the propane and butane are thermally or catalytically cracked and polymerized to gasoline or used to produce components which serve as the starting point for the production of a large number of chemical products. Among the latter are such materials as synthetic resins and plastics, and synthetic rubber.

Introduction

There is certain basic information that is required before a discussion of multicolumn fractionation can be carried on. It is not the purpose of this paper to go into detail on the fundamentals of vapor liquid equilibria, vaporization and condensation calculations, and the like as these subjects are well covered by past and present publications[1,2,3,4]. The points where these phenomena bear upon the problem at hand will, however, be reviewed briefly.

First is the recognition of the composition and nature of the material that we are attempting to fractionate. The lighter fractions of wild natural gasoline (condensate from compression plants or stripping still overhead from absorption plants) are as follows in order of decreasing volatility: methane, ethane propane, isobutane, normal butane, isopentane, normal pentane, and residue (hexanes and heavier). The first five of these components named (methane through normal butane) are gaseous at normal conditions of temperature and pressure. The butanes, both iso- and normal and to a lesser extent propane, may occur under normal conditions of temperature and pressure as liquids when dissolved in heavier constituents, such as the pentanes and the residue consisting of hexanes and heavier.

An appreciation of the volatility of the components is in order before discussing the separation of one from the other by distillation. Figure 1 is a vapor pressure chart for pure hydrocarbons on which is plotted the vapor pressure of the compounds, ethane through normal pentane, as a function of temperature. The co-ordinates for this chart are purely arbitrary ones with regard to spacing such that the vapor pressure of individual hydrocarbons when plotted thereon appears as straight line. This chart is similar to that issued by the CNGA last year.

Table 1 lists significant properties of the components propane, isobutane, normal butane, isopentane, and normal pentane.

In dealing with mixtures of hydrocarbons we frequently encounter one or more of the components at conditions of temperature and pressure widely different from those which would be characteristic of the vapor pressure of the pure component itself. For example, propane which exerts a vapor pressure of 190 lb./sq.in. absolute at a temperature of 100°F. can exist as a liquid in solution in gasoline at a temperature of 100°F. and a pressure of only 15 lb./sq.in. absolute. Also isopentane, which exerts a vapor pressure of 19.7 lb./sq. in. absolute at 100°F., can exist as a vapor at a temperature of 100°F. and a pressure of 400 lb./sq.in. absolute in the presence of some lighter materials, such as methane and ethane. The effective vapor pressure of hydrocarbons at conditions of temperature and/or pressure appreciably different from those corresponding to the pure material is considerably different from the pure component vapor pres-

TABLE 1
PROPERTIES OF THE LIGHTER COMPONENTS OF NATURAL GASOLINE

Component	Vapor Pressure at 100°F Lb./Sq. In. Abs.	Knock Rating ASTM Motor
Propane.....	187	..
Iso-Butane.....	72	99
Normal Butane...	50.5	90
Iso-Pentane.....	19.7	90–93
Normal Pentane..	15.7	66

FIGURE 1
VAPOR PRESSURE CHART FOR HYDROCARBONS

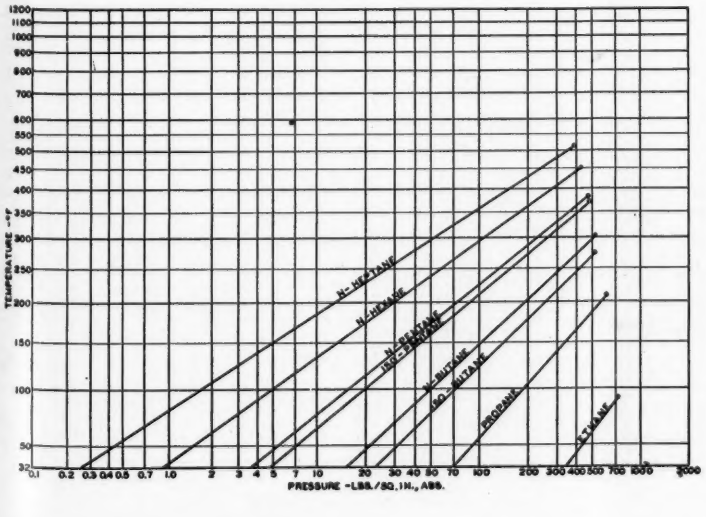
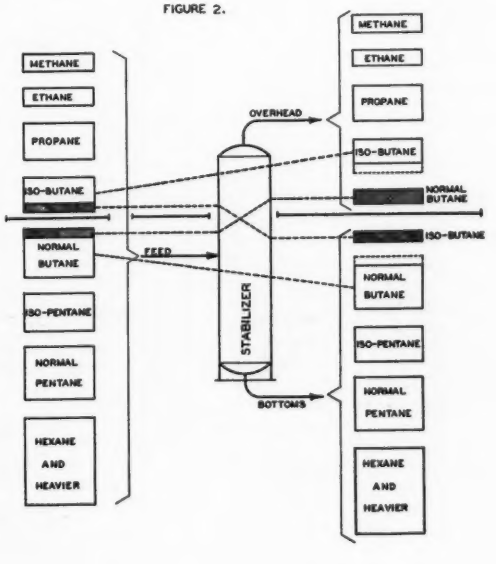


FIGURE 2.



sure as drawn in Figure 1. This vapor pressure deviation phenomenon was ably discussed in a paper by Bowman at the May, 1939 meeting of this society. The actual vapor pressure and resultant vapor liquid equilibrium is expressed for convenience in terms of K=y/x in which y equals the mol fraction of the component in question in the vapor phase and x equals the mol fraction of that same component in the equilibrium liquid phase. This ratio, y/x, is a function of the total composition of the system, including both liquid and vapor phases, in addition to the temperature and pressure of the system. Actually, it has been found that for components of natural gasoline over a wide range of conditions, this ratio y/x can be expressed in terms of the convenient variables of temperature and pressure, so that a plot of y/x, or K, against temperature for a given component has a shape roughly similar to that of the vapor pressure relationships of Figure 1. The principal difference is that a component existing in a system under a total pressure greater than its true vapor pressure exerts an effective vapor pressure higher than its true vapor pressure; and a component existing in a system under a total pressure lower than its normal vapor pressure exerts an effective vapor pressure lower than its true vapor pressure.

Table 2 lists the K=y/x values for the components ethane, propane, isobutane, normal butane, and isopentane. These values are given at temperatures of 100°F., 150°F., 200°F., and 300°F., and at pressures corresponding to those which would be encountered in fractionators effecting separations between each of a pair of components. Thus, the K=y/x values for the pair ethane and propane are given at 600 lb./sq.in. abs. (585 lb./sq.in. gage) which is the approximate pressure required to effect condensation of ethane overhead at a temperature of 85°F. obtainable with ordinary atmospherically cooled water. Similarly, the K=y/x values for the pair isopentane and normal pentane are given at a pressure of 30 lb./sq.in. abs. (15 lb./sq.in gage).

The four right-hand columns of Table 2 present the ratio of K's for each pair of components above. This ratio value is called the "relative volatility" and is obtained by dividing the "K" for the lighter component of each pair (for example, ethane, in the ethane-propane pair) by the "K" for the heavier component at the same temperature and pressure. At 600 lb./sq.in abs. and 150°F., ethane has a K=y/x of 1.6 and propane a K =y/x of 0.65 so that the ratio of K's (relative volatility) is

$$\frac{1.6}{0.65} = 2.5.$$

Also, at 90 lb./sq.in. abs. and 150°F., isobutane has a K=y/x of 1.5, and normal butane a K=y/x of 1.2, the ratio of K's (relative volatility) is hence

$$\frac{1.5}{1.2} = 1.3.$$

Above a liquid mixture containing equal amounts of ethane and propane at 600 lb. pressure and 150°F. (conditions such as might occur on a plate in a high pressure stabilizer), there will be a vapor having ethane in a concentration 1.6 times its concentration in the liquid, and propane in a concentration only 0.65 its concentration in the liquid. It follows that the ethane and propane concentrations in the vapor will be in the ratio of 1.6/0.65=2.5 and the vapor will be considerably richer in the lighter component ethane, and considerably leaner in the heavier component propane than the liquid with which said vapor is in equilibrium. This is the mechanism by which distillation effects separation of materials of different volatility.

A feed containing components in various concentrations is introduced into a distillation tower and the vapors become richer in the lighter components than they do in the heavier components because of differences in volatility. The action of a fractionating tower is to effect a succession of vaporizations and condensations on the trays and in so doing the vapors rising to the top of the column become progressively enriched with respect to the lighter components while the liquid flowing to the bottom of the tower becomes progressively enriched with respect to the heavier components.

TABLE 2

Separation	Pressure for Condensing at 85°F Lb./Sq. In. Abs.	K = Y/X at Pressure and 100°F	150°F	200°F	300°F	Relative Volatility at Pressure and 100°F	150°F	200°F	300°F
Ethane from Propane	600	1.2	1.6	1.9	2.7	3.3	2.5	2.1	1.7
		.37	.65	.92	1.6				
Propane from Iso-Butane	175	1.1	1.7	2.4	4.6	2.2	2.0	1.8	1.7
		.51	.86	1.3	2.7				
Propane from Iso-Butane	250	.78	1.25	1.8	3.4	2.0	1.9	1.8	1.7
		.39	.66	1.0	2.0				
Iso-Butane from Normal Butane	90	.85	1.5	2.4	4.9	1.3	1.3	1.3—	1.2+
		.63	1.2	1.9	4.0				
Normal Butane from Iso-Pentane	75	.75	1.4	2.2	4.7	2.6	2.3	2.0	1.7
		.29	0.6	1.1	2.7				
Iso-Pentane from Normal Pentane	30	.66	1.4	2.6	6.5	1.2+	1.1+	1.1+	1.1+
		.53	1.25	2.3	5.8				

General Notes on Fractionation

Figure 2 is a schematic representation of the type of fractionation by distillation commonly encountered in the natural gasoline industry. Feed, consisting of the components methane, ethane, propane, isobutane, normal butane, isopentane, normal pentane, and a residual fraction described as hexane and heavier, is pumped to a stabilizer tower which may operate at a range of pressures from 150 to 300 lb./sq.in abs. The relative magnitude of the components present is indicated by the size of the blocks representing each individual component, and the composition thus indicated is comparable to that characteristic of wild natural gasoline produced by low pressure absorption. The pictorial repre-

FIGURE 3.

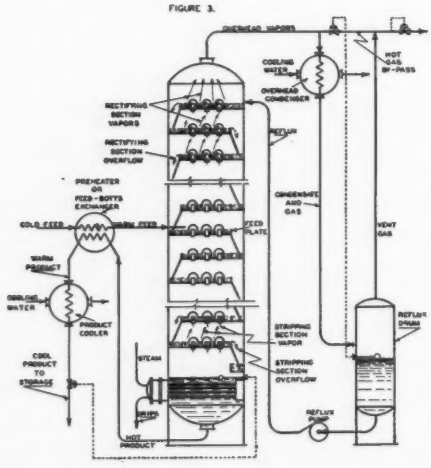
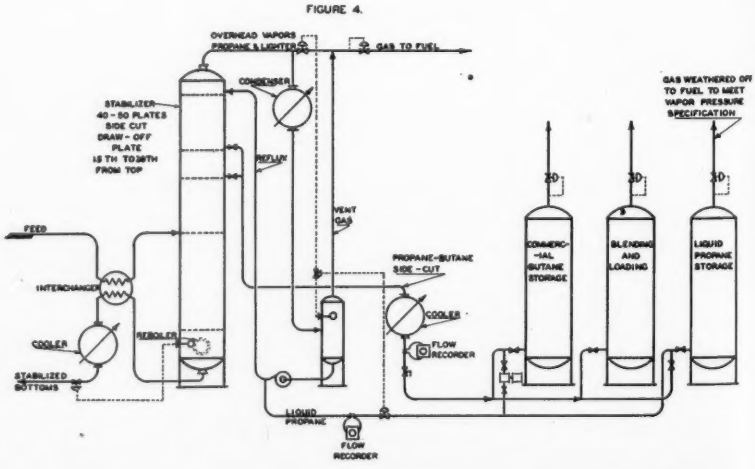
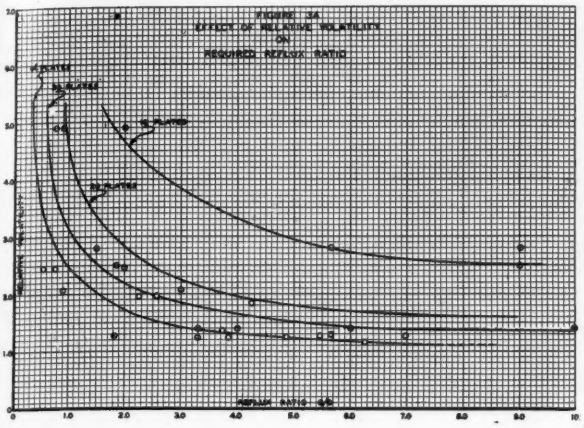


FIGURE 4.





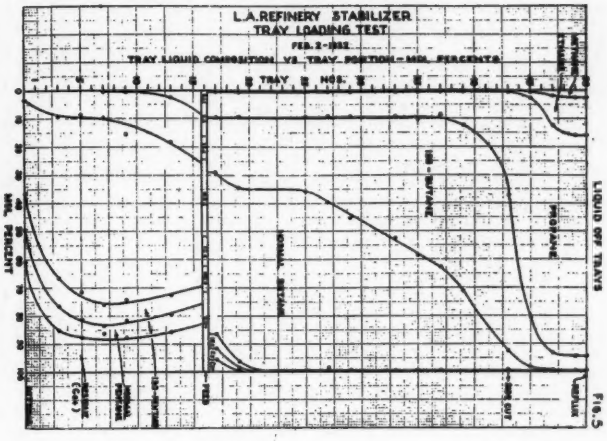


FIG. 5

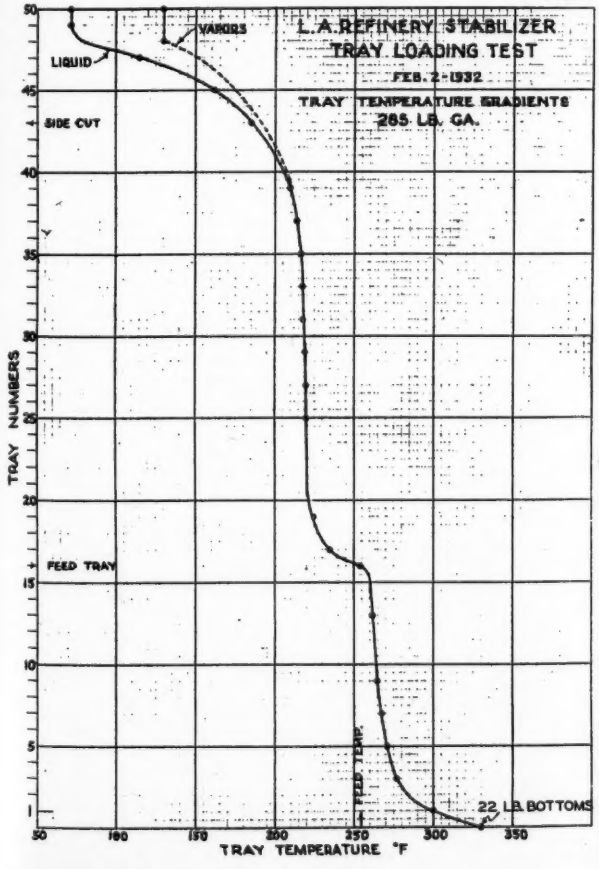
sentation shows a separation between isobutane and normal butane being accomplished in the stabilizer and for the feed stock considered this corresponds to the production of 22 lb. Reid vapor pressure gasoline. A substantially complete recovery of all of the normal butane present in the feed is required. From the fact that normal butane has a lower vapor pressure than isobutane, it is desirable to include in the gasoline virtually all of the normal butane in the feed with a minimum inclusion of isobutane and a minimum loss of normal butane overhead. A greater over-all volume of 22 lb. Reid vapor pressure material is produced thereby. The problem of stabilization in this case resolves itself into a problem of separating between the isobutane and the normal butane components in the feed, and these components are called the "key" components. The separation between isobutane and normal butane is not perfect, and a quantity of isobutane appears in the 22 lb. Reid vapor pressure gasoline and a quantity of normal butane appears in the overhead. This is shown schematically in Figure 3, wherein the shaded areas represent isobutane and normal butane which appear where they are not desired; namely in the stable gasoline and in the overhead. The separation between the propanes and isopentanes need hardly be considered for these components have a relative volitality far greater than that of isobutane and normal butane, such that a reasonably effective separation of isobutane from normal butane will result in a substantially complete separation of propane from isopentane.

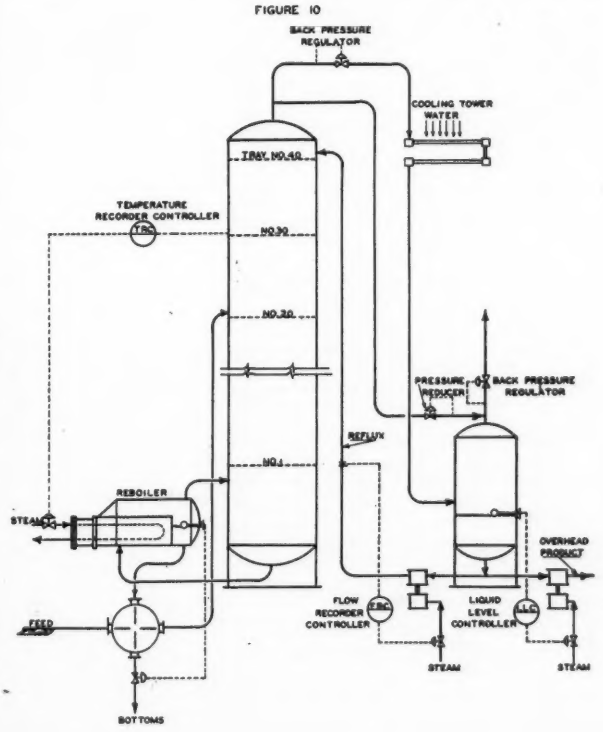
The concept of the key components is a very useful one when considering the actual gasoline stabilization or fractionation.

Figure 3 is a somewhat more detailed drawing of the column effecting this separation, and shows the processes going on inside the column whereby the separation is effected. Although only a single column is shown, the internal processes are common to each unit of a multicolumn fractionator installation.

Cold feed, consisting of raw natural gasoline from the accumulator, is pumped through an interchanger extracting heat from the hot stable gasoline product. The

FIG. 6





SUMMARY OF GASOLINE FRACTIONATION

Description	1 Stabilizer			2 Stabilizer			3 Natural Gasoline			4 Propane-Butane-Pentane			5 Underwood's Example		
	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms
Components (mol per cent):															
H_2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
CH_4	0.02	0.0333	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
C_2H_4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
C_2H_6	0.10	0.316	.....	0.0584	0.21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
C_3H_6	0.08	0.19	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
C_3H_8	0.125	0.39	0.0325	0.189	0.677	0.0009	0.15	0.477	0.01	0.3	0.9599	0.0172	.....	.....	.....
$i\text{-}C_4H_{10}$	0.035	0.022	0.041	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$n\text{-}C_4H_{10}$	0.150	0.019	0.211	0.384	0.113	0.481	0.30	0.513	0.209	0.35	0.0400	0.483	.....	.....	.....
$i\text{-}C_5H_{12}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$n\text{-}C_5H_{12}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
C_6H_{12}	0.152	.....	0.222	0.241	.....	0.331	0.55	0.010	0.781	0.35	.....	0.50	.....	.....	.....
C_6H_{14}	0.113	.....	0.165	0.128	.....	0.187	.....	.....	.....	.....	.....	.....	0.31	0.536	.....
C_7H_{16}	0.090	.....	0.132	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.266	0.46	0.00134
C_8H_{18}	0.085	.....	0.124	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.187	0.004	0.437
C_9H_{20}	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.125	.....	0.296
$C_{10}H_{22}$	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.112	.....	0.266
360°F	0.070	.....	0.102	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Key Components:															
Light key		C_3H_8			C_3H_8			C_3H_8			C_3H_8			C_7H_{16}	
Heavy Key		$n\text{-}C_4H_{10}$			C_4H_{10}			C_4H_8			C_4H_{10}			C_8H_{18}	
Relative volatility $\alpha = \frac{Klk}{Khk}$	α at 300 lb. abs. and 150°F. =2.45			α at 200 lb. and 150°F. =1.95			α at 150 lb. ga. and 150°F. =2.8			α at 200 lb. and 150°F. =2.5			α at 15 lb. and 160°F. =2.07		
Material Balance:															
Basis: 100 mols of feed															
Feed		100			100			100			100			100	
Overhead		31.6			27.8			30			30			57.8	
Bottoms		68.4			72.9			70			70			42.2	
Key Component Recovery:															
% light key component in overhead		98.5			99.6			95.4			96.0			99.9	
% heavy key component in bottoms		96.			91.4			99.5			96.6			98.8	
Reflux Ratio-Plate Relationship:															
O/D or L/D above feed plate	0.53[1]	2.0[1]	∞[1]	2.26	2.57	∞	1.5	5.67	9.0	∞	1.85	9	∞	0.9	3	∞
L/V below feed	0.76[2]	2.0[2]	∞[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Theoretical plates	∞[1]	11[1]	7.4[1]	∞	25.8	9.8	∞	8.5	7.8	6.7	∞	9.5	7.6	∞	16	12.0
	∞[2]	15[2]	9.2[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$\frac{(O/D)-(O/D)m}{(O/D)+1}$	0[1]	0.49[1]	1.0[1]	0	0.087	0.555	0	0.625	0.75	1.0	0	0.715	1.0	0	0.525	1.0
	0[2]	0.414[2]	0.322[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$\frac{S-Sm}{S+1}$	1.0[1]	0.257[1]	0[1]	9.8	1.0	0	1.0	0.171	0.11	0	1.0	0.165	0	1.0	0.222	0
	1.0[2]	0.322[2]	0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1]For Case A cold fee '.
[2]For Case B same as Case A except recovery of NC_4 was 99% instead of 96%.

warm feed then enters the stabilization column. In the bottom of the column is located a reboiler, consisting of a shell and tube type exchanger using steam for the heating medium. Steam is condensed, thereby liberating its latent heat which in turn vaporizes a portion of the gasoline bottoms surrounding the tube. These vapors rise through the lower trays of the column, contacting as they rise, a down-flowing liquid stream as discussed below. The over-head consisting of the net butanes and lighter produced by stabilization and the cycling reflux stream flows through a condenser coil. At the operating pressure of, say, 250 lbs., the overhead is totally condensed and accumulates in the reflux drum. The reflux pump returns the reflux cycle to the top of the tower. As more feed is run to the column and the quantity of overhead increases correspondingly, a float in the reflux drum actuates a by-pass in the overhead vapor line around the condenser so that hot gases comprising the net overhead from the column are produced. Cool reflux returned to the top plate is vaporized through contact with hot vapors rising through the upper plates of the column and cycles through the condenser to the reflux drum and back to the top of the column, extracting each time a certain amount of heat. This heat is removed from the hot vapors rising through the top plates of the column and effects a condensation of a portion of these vapors. Warm condensate from the top plates of the column flows down and contacts still hotter vapors in the lower trays, and effects their condensation and the revaporization of the condensate from the upper trays. There is therefore set up within the column a series of vaporization and condensation cycles whereby vapors from the lower trays of the column condense on trays higher in the column and return to the lower trays to be again vaporized by hotter vapors rising from below. This repeated vaporization and condensing enriches the vapors with respect to the more volatile components and enriches the liquid with respect to the less volatile components in the manner that is described in the beginning of this paper.

The gasoline consisting of the residue of hexanes and heavier, normal pentanes, the isopentanes, the majority of the normal butanes from the feed, and a portion of the isobutanes from the feed is then produced as bottoms from the tower. The hot gasoline bottoms are cooled first by interchange with the cold feed to the column and then by cooling water and then are produced to storage.

The vapor stream at any point in the upper part of the column which consists of the cycling vapor (that which condenses on a higher tray and is returned for revaporization below) and the overhead vapor production is called the rectifying section vapor. The liquid at the corresponding point which consists of the cycling liquid (that which is vaporized on the lower trays) and that which finally appears in the bottoms product is called the rectifying section overflow. The ratio of rectifying section overflow to rectifying section vapor expressed in comparable units such as pounds of rectifying section overflow to pounds of rectifying section vapor or mols of rectifying section overflow to mols of rectifying section vapor, determines in large measure the degree of

Description	6 Ethylene Fractionation			7 Ethylene Fractionation			8 Depentanizer No. 1			9 Depentanizer No. 2			10 Debutanizer 10/24/40 6 p.m.		
	Feed	No. 1 Net Overhead	Bottoms	Feed	No. 2 Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms
Components (mol per cent):															
H_2	0.17	0.374													
CH_4	0.28	0.573	0.0366	0.0366	0.08										
C_2H_4	0.25	0.044	0.421	0.421	0.90	0.017									
C_2H_6	0.12	0.006	0.211	0.212	0.02	0.375									
C_3H_6	0.13		0.238	0.238		0.440									
C_3H_8	0.03		0.055	0.055		0.101									
i-C_4H_{10}													0.1035	0.360	
n-C_4H_{10}	0.02	0.366		0.0366	0.067		0.083	0.181		0.0302	0.078		0.0763	0.187	0.031
i-C_4H_8							0.255	0.582	0.032	0.311	0.79	0.007	0.280	0.440	0.176
n-C_4H_8							0.180	0.238	0.140	0.100	0.132	0.078			
C_5H_{12}															
C_5H_{10}															
C_5H_8															
C_6H_{14}															
C_6H_{12}															
C_6H_6															
C_6H_{12}(Res)															
C_{7+}							0.482		0.812	0.559		0.915	0.566		0.794
360°F.															
Key Components:															
Light key	CH_4			C_2H_4				i-C_4H_8			i-C_4H_8			i-C_4H_{10}	
Heavy Key	C_2H_6			C_2H_6				n-C_4H_8			n-C_4H_8			n-C_4H_{10}	
Relative volatility $\alpha = \frac{K_{lk}}{K_{hk}}$	∞ at 600 lb. and 120°F. = 4.9			∞ at 500 lb. and 120°F. = 1.4			∞ at 1 atm. and 200°F. = 1.16			∞ at 1 atm. and 200°F. = 1.16			∞ at 265 lb./sq. in. abs. and 185°F. = 1.26		
Material Balance:															
Basis: 100 mols of feed															
Feed	100			100			100			100			100		
Overhead	45.4			45.9			59.4			38.8			28.8		
Bottoms	54.6			54.1			41.6			61.2			71.2		
Key Component Recovery:															
% light key component in overhead	92.9			98.3			92.5			98.7			70.5		
% heavy key component in bottoms	96.6			95.6			46.3			47.9			49.7		
Reflux Ratio-Plate Relationship:															
L/D or L'/D' above feed plate	0.78	0.9	2.0 ∞	3.3	4.0	6.0 10.0 ∞		6.25			10.7			3.28	
L/V below feed								1.23			1.18			3.33	
Theoretical plates	∞	8.0	3.6 1.4	∞	37	28 23 17.7		Actual plates = 24			Actual plates = 24			Actual plates = 50	
$\frac{(O/D)-(O/D)_m}{(O/D)+1}$	0	0.063	0.407 1.0	0	0.14	0.386 0.609 1.0									
$\frac{s-s_m}{s+1}$	1.0	0.6	0.333 0	1.0	0.483	0.332 0.204 0									
Mass velocities													Top Section lb./hr./sq.ft.	Feet	Bottom Section lb./hr./sq.ft.
Calculated													3,880	3.6	4,430
Actual													1,940	5.0	730
														2.0	
														5.0	

fractionation that will take place in the rectifying section.

The corresponding quantities in the lower part of the tower are called the stripping section vapor and stripping section overflow. The ratio of stripping section overflow to stripping section vapor in a manner similar to the effect noted in the rectifying section, determines in large measure the degree of fractionation obtained in the stripping section.

Another major item determining the degree of fractionation in both the rectifying and stripping sections of the tower is the number of plates in each section which naturally determines the number of vaporizations and condensations that will take place therein. The larger the number of plates for a given ratio of overflow to vapor, the sharper the separation. Generally the closer the ratio of overflow to vapor for a given number of plates, the sharper the separation. It is clear that the ratio of overflow to vapor in the rectifying section must always be less than 1, or by material balance the vapor equals the reflux plus the overhead vapor. The ratio of overflow to vapor in the stripping section must always be greater than 1, or by material balance the overflow must equal the vapor plus the bottoms product.

Figure 3A is a rough plot to illustrate the significance of relative volatility on reflux ratio for fractionation. This chart plots relative volatility for the key components between which separation is desired vs. required reflux ratio expressed as volumes reflux per volume of overhead product. Lines for various plate numbers are sketched in approximate location. It will be noted that the required reflux ratio increases as the relative volatility approaches 1.0 and reaches infinity at this value. That is, no amount of reflux or plates can effect the separation of components of identical K values by simple distillation. The smaller the relative volatility, the more difficult the separation, hence referring to Table 2, the separations encountered in natural gasoline work, listed in order of increasing difficulty are:

Ethane from propane
Normal from isopentane
Propane from isobutane
Isobutane from normal butane
Isopentane from normal pentane

and the respective reflux ratios required are approximately:

1.5 to 1.0
2.5 to 1.0
3.0 to 1.0
6.0-8.0 to 1.0
10.0-12.0 to 1.0

The above figures and Figure 3A are not to be taken as rigorous and should not be used for design purposes. The reflux ratio, plate requirement, etc. should be checked for the individual separation under consideration by one or several of the methods reported in the literature. The reflux and plate requirements vary widely with the sharpness of separation between components desired. The lines of Figure 3A are set up for 90-95% recovery of the lighter key component in the overhead and a similar recovery of the heavy component in the bottoms. If the recovery quota can be relaxed, a considerable reduction in reflux can be tolerated. For example, in the separation of isopentane from normal pentane, the recovery of 50% of the isopentane with less than 10% normal pen-

Description	11 Debutanizer 10/24/40 Midnight				12 Debutanizer 11/26/40 Noon				13 Debutanizer Average May 9-12, 1940				14 Debutanizer May 31, 1940 7 a.m.				15 Debutanizer Average May 13-18, 1940			
	Feed	Net Overhead	Bottoms		Feed	Net Overhead	Bottoms		Feed	Net Overhead	Bottoms		Feed	Net Overhead	Bottoms		Feed	Net Overhead	Bottoms	
Components (mol per cent):																				
H_2	0.0005	0.00166			0.00042	0.00172			0.00091	0.0035			0.000407	0.0017						
CH_4																				
C_2H_4																				
C_2H_6	0.00506	0.0169			0.00464	0.0191			0.00498	0.0194			0.00424	0.018			0.00346	0.0114		
C_3H_6																				
C_3H_8	0.101	0.336			0.0951	0.392			0.0749	0.290			0.118	0.493			0.0765	0.251		
i-C_4H_{10}	0.0744	0.252	0.0073		0.0931	0.280	0.0335		0.1385	0.330	0.0761		0.116	0.314	0.0536		0.1058	0.272	0.0329	
n-C_4H_{10}	0.249	0.415	0.1787		0.249	0.310	0.230		0.240	0.369	0.200		0.235	0.174	0.255		0.242	0.465	0.145	
i-C_5H_{12}																				
n-C_5H_{12}																				
C_6H_{14}																				
C_7H_{16}																				
C_8H_{18}																				
C_9H_{20}(Est)																				
360°F	0.571		0.815		0.559		0.737		0.840		0.728		0.523		0.692		0.570		0.822	
Key Components:																				
Light key		i-C_4H_{10}				i-C_4H_{10}				i-C_4H_{10}				i-C_4H_{10}				i-C_4H_{10}		
Heavy Key		n-C_4H_{10}				n-C_4H_{10}				n-C_4H_{10}				n-C_4H_{10}				n-C_4H_{10}		
Relative volatility $\alpha = \frac{K_{lk}}{K_{hk}}$	α 265 lb. 185°F. = 1.26				α 265 lb. 185°F. = 1.26				α 265 lb. 185°F. = 1.26				α 265 lb. 185°F. = 1.26				α 265 lb. 185°F. = 1.26			
Material Balance:																				
Basis: 100 mols of feed																				
Feed	100				100				100				100				100			
Overhead	29.8				24.3				25.8				24.0				30.5			
Bottoms	70.2				75.7				74.2				76.0				69.5			
Key Component Recovery:																				
% light key component in overhead	93.4				73.0				61.5				65.0				78.4			
% heavy key component in bottoms	50.2				69.8				61.5				82.1				41.6			
Reflux Ratio-Plate Relationship:																				
O/D or L/D above feed plate		3.82				4.83				1.82				5.62				1.81		
L/V below feed		1.68				1.80				1.88				1.50				1.75		
Theoretical plates		Actual plates = 50				Actual plates = 50				Actual plates = 50				Actual plates = 50				Actual plates = 50		
(O/D)-(O/D)m																				
(O/D) +1																				
S −Sm																				
S+1																				
	Top Section		Bottom Section		Top Section		Bottom Section		Top Section		Bottom Section		Top Sec.		Bottom Section		Top Section		Bottom Section	
	lb./hr./ sq.ft.	Feet	lb./hr./ sq.ft.		lb./hr./ sq.ft.	Feet	lb./hr./ sq.ft.		lb./hr./ sq.ft.	Feet	lb./hr./ sq.ft.		lb./hr./ sq.ft.	Feet	lb./hr./ sq.ft.		lb./hr./ sq.ft.	Feet	lb./hr./ sq.ft.	
Mass velocities																				
Calculated	3,640	4.2	4,660		3,670	4.0	4,600		3,880	2.6	4,580		3,780	3.8	4,520		3,660	2.8	4,610	
Actual	2,530	5.0	2,700		2,390	5.0	2,450		1,200	5.0	2,190		2,160	5.0	3,170		1,150	5.0	1,800	

tane contamination can be accomplished in a 24-plate tower with a reflux ratio of about 6.1. This is well below the reflux rate at which a number of isobutane towers operate in spite of their easier separation, because of the requirements for maximum isobutane recovery in the latter case.

Along this line, it might be noted that 85% recovery of 95% isobutane can be made with a reflux ratio of 5.1, 94% recovery with a reflux ratio of 7.1, and 98% with a reflux of 10.1. These are typical figures for columns containing 45, 50, and 65 plates.

A further factor affecting separation between components such as isobutane and normal butane is the presence of lighter and heavier components. The separation between isobutane and normal butane is made more difficult (i.e., requires more reflux or plates) when propane and lighter is present and/or when pentane and heavier is present. This is because some of the trays, especially in the vicinity of the feed tray, are utilized for separation of the non-key components. Figure 5 illustrates this point.

Liquid Gas Production

Liquid petroleum gas or L.P.G. is a common commodity to producers and refiners of natural gasoline. It appears in two general forms or products. (1) commercial propane, and (2) commercial butane. The CNGA recognizes[5] six grades of liquid gas designated as A, B, C, D, F, and ranging in vapor pressure from 80 lb./sq.in. gage of 100°F. (fundamentally butane) to 200 lb./sq.in. gage at 100°F. (predominantely propane.) The production of these commodities requires the ability to fractionate between propane and butane on the one hand and butane and pentane on the other.

1. Production of liquid petroleum gases from a single tower.

Figure 4 is a diagrammatic representation of fractionator facilities for the production of both liquid propane and liquid butane from a single tower. In addition to the overhead and bottoms production streams shown in the preceding Figures 2 and 3, a third product stream is drawn from the column at a point in the rectifying section approximately between the top plate and the feed plate.

In the general discussion of fractionation above it was noted that liquid on trays in the rectifying section of the tower is lightest at the top and becomes heavier toward the feed tray due to the absorbing out action on the heavy key component. There is some point in the tower above the feed tray where a liquid "side cut" stream can be drawn at a rate less than the overhead rate without the side cut, and this stream will be rich in butane and deficient in propane. At the proper rate of side cut withdrawal, with adequate top reflux and with the side cut point properly located, the side cut streams can be made to consist of all the butane which would normally appear overhead plus some of the propane. The overhead thus consists only of propane and lighter. In practice this point of withdrawal is determined by temperature gradient in the rectifying section of the tower, and the material is withdrawn to a point whose temperature corresponds, as determined by calculation and experience, to the desired composition. For a given feed composition, column operating pressure, and vapor pressure of stable product being produced from the bottom, the lower the temperature of the side cut stream, the larger the per cent of pro-

Description	16 Debutanizer June 1, 1940 1 a.m.			17 De-isobutanizer Unit 101 Alkylation Plant Test December 19, 1940,			18 Depropanizer Unit 101 Alkylation Plant Test August 14, 1940			19 De-isobutanizer Unit 101 Alkylation Plant Test August 30, 1940		
	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms	Feed	Net Overhead	Bottoms
Components (mol per cent):												
H_2	0.0013	0.0054										
CH_4							0.0116	0.051				
C_2H_4							0.0001	0.035	0.0002			
C_2H_6	0.0049	0.0192					0.227	0.914	0.0276	0.0087	0.0126	
C_3H_6							0.173		0.2335	0.6437	0.9274	
C_3H_8	0.0805	0.316		0.0075	0.0106		0.412		0.5320	0.2385	0.0600	0.6436
$i\text{-}C_4H_{10}$	0.113	0.400	0.016	0.697	0.971	0.0302	0.082		0.1064	0.0437		0.1428
$n\text{-}C_4H_{10}$	0.241	0.280	0.235	0.157	0.0185	0.4986	0.0852		0.1103	0.0150		0.0520
$i\text{-}C_5H_{12}$				0.0715		0.245						
$n\text{-}C_5H_{12}$												
C_6H_{14}												
C_7H_{16}												
C_8H_{18}												
C_9H_{20}												
$C_{10}H_{22}$	0.561		0.750	0.0062		0.227				0.0495		0.1616
360°F												
Key Components:												
Light key			$i\text{-}C_4H_{10}$			$i\text{-}C_4H_{10}$		C_3H_8			$i\text{-}C_4H_{10}$	
Heavy Key			$n\text{-}C_4H_{10}$			$n\text{-}C_4H_{10}$		$i\text{-}C_4H_{10}$			$n\text{-}C_4H_{10}$	
Relative volatility $\alpha = \frac{K_{lk}}{K_{hk}}$		α 265 lb. 185°F. = 1.26			1.35			1.83			1.27	
Material Balance: Basis: 100 mole of feed												
Feed		100			100			100			100	
Overhead		25.9			71			22.5			69.4	
Bottoms		74.1			29			77.5			30.6	
Key Component Recovery:												
% light key component in overhead		89.8			98.5			90.6			100	
% heavy key component in bottoms		72.5			92.5			100.0			82.55	
Reflux Ratio-Plate Relationship:												
O/D or L/D above feed plate		6.99			3.72			4.24			5.45	
L/V below feed		1.44			1.10			1.56			1.08	
Theoretical plates		Actual plates = 50			Actual plates = 50			Actual plates = 34			Actual plates = 50	
$\frac{(O/D)-(O/D)_m}{(O/D)+1}$												
$\frac{S-S_m}{S+1}$												
	Top Section lb./hr./ sq.ft.	Feet	Bottom Section lb./hr./ sq.ft.	Top Section lb./hr./ sq.ft.	Feet	Bottom Section lb./hr./ sq.ft.	Top Section lb./hr./ sq.ft.	Feet	Bottom Section lb./hr./ sq.ft.	Top Section lb./hr./ sq.ft.	Feet	Bottom Section lb./hr./ sq.ft.
Mass velocities												
Calculated	3,780	3.8	4,530	2,690	6.9	2,960	3,070	2.7	3,860	2,710	7.2	2,810
Actual	2,220	5.0	3,070	3,540	6.0	4,030	1,340	4.0	2,250	3,890	6.0	3,820
		4.1			7.0			3.1			7.0	
		5.0			6.0			4.0			6.0	

pane and conversely, the higher the temperature of the side cut stream, the larger the per cent of butane in the cut.

Figure 5 shows the actual concentration gradient for the components methane, ethane, isobutane, and normal butane and heavier through a stabilizer which was producing a commercial butane side cut, and Figure 6 is the tower temperature gradient. These data have appeared in several publications[6]. This figure plus preceding discussion illustrates why it is impossible to produce a pure component as a side cut from a frac-

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tionating column. All of the material lighter than the desired side cut component must pass by the side cut tray on the way from the feed plate to the top of the tower and because of equilibrium or tendency toward equilibrium on each plate in the rectifying section of the tower there will be at least a small concentration of material lighter than that desired dissolved in the liquid side cut stream.

The advantages of the single tower operation for the production of liquid petroleum gases are mainly those of equipment:

1. Only one tower need be installed, so equipment cost is low.

2. Existing towers primarily for straight stabilization of natural gasoline can be quite readily modified to include means for withdrawal of liquid from trays in the rectifying section, thus producing liquid propane and liquid butane products.

The disadvantages are briefly as follows:

1. Control. As noted the composition of the withdrawn side cut is a function of the composition of the feed and is roughly determined during operation by the temperature of the side cut tray. Constant attention is required during operation as the temperature and therefore the composition of the material on the side cut trays vary quite widely with a relatively small variation in the composition of the feed to the stabilizer.

2. Operation. The withdrawal of a butane side cut containing a portion of the propane which would otherwise appear in the overhead means that the overhead reflux is deficient in heavy materials which aid in condensation. Therefore relatively minor upsets in the cooling system by which reflux is provided may result in inability to obtain a low enough temperature to produce a condensate for reflux and column control is lost.

3. Loss of product. Referring to item 2 above, the same exceedingly volatile characteristics of the overhead material which make it difficult to produce reflux at all times due to inability to effect condensation also involves the loss to gas of propane which might otherwise be recovered as a liquid and sold.

2. Production of liquid petroleum gas products from 2 columns.

To reduce the difficulties of control and operation and a loss of potential propane products noted as characteristic of single column procedure for the production of liquid petroleum gas, liquid propane and liquid butane can be made by the use of two columns operating in series.

Figure 7 shows diagrammatically a typical installation to effect the separation of propane and butane from natural gasoline. Raw feed from the wild gasoline accumulator is fed to the first of the towers in series from which is produced overhead practically all of the propane and all of the methane and ethane present in the feed. Depending upon the composition of the feed and hence the difficulty of effecting condensation for reflux overhead, the tower will operate a pressure ranging from 200-300 lb./sq.in. Since propane is almost completely produced overhead and is present in the bottom stream in only a small quantity, the overhead material is easier to condense than is the case in the single column set up where a considerable quantity of the propane is being removed along with the butane in a side cut from the rectifying section. This aids both in control of the column by minimizing the possibility of loss of reflux due to upsets in the cooling system, and also effects a greater percentage of condensation of the propane which is then available after weathering or other treatment to meet vapor pressure specifications for sale. Control is also simplified in that such close attention to bottom temperature is not required as with the case of side cut temperature in the production of butane as a side cut from the rectifying section of the single column set up. Principal attention is required to avoid contamination of the overhead with butane, whereas the presence of a reasonable or small amount of propane in the bottoms is not deleterious inasmuch as propane is generally blended back with the overhead butane product from the second tower to meet vapor pressure specifications. The bottoms from this primary tower consisting of a trace of propane, practically all of the isobutane, all of the normal butane, and all of the heavier components present in the feed are pressured to the secondary column, and the rate of transfer is controlled by a liquid level controller on the bottom of the primary tower. The secondary tower which is essentially a debutanizer can operate at a considerably lower pressure than the primary depropanizing tower or for that matter a normal stabilizer. Customary pressures for this tower range from 40 to 60 lb./sq.in. gage. Operation at 100-200 lb. is not uncommon, however. The bottoms temperature is adjusted to that value which will produce the desired vapor pressure material in a manner similar to normal stabilizer operations, and the overhead consisting predominantly of butane (iso- and normal), is condensed, a portion returned for reflux, and the net overhead produced to liquid gas storage.

The advantages of the double column installation discussed are:

1. Easier control for the production of commercial butane.

2. Less possibility of loss of reflux due to condensation difficulties.

3. Greater propane recovery for potential sale.

The disadvantages of the installation are:

1. Cost. The installation costs approximately twice as much as the corresponding single tower installation. This is so even though one or the other towers may be considerably smaller than the single tower installation above, because in a large measure the cost of the installation is determined not by the weight of the vessel itself, but by the required amount of piping, foundation work, instrumentation, etc.

2. Although reflux difficulties are considerably reduced as compared with the single column installation, the light fractions, methane and ethane, are still present in the overhead and may present difficulties on occasion.

3. As a corollary to 2 above, fractional condensation of the overhead still results in a loss to gas of propane which in certain instances might be salable as liquid gas if recovered. To effect condensation and recovery, column pressures are generally rather high with the result that the condensate as produced contains an excessive amount of dissolved methane and ethane which must be removed before the product will meet vapor pressure specifications. This is generally done by a weathering operation in the storage tank, whereby the pressure on the tank is gradually reduced from stabilizer pressure down to that corresponding to the specifications for the material after correcting the pressure to the specification pressure of 100°F. This weathering operation results in an appreciable loss of propane to gas, no matter how carefully conducted. The more slowly this weathering is conducted, the greater the staging effect and the less loss of propane to gas. Shipment schedules and so forth generally make it difficult to weather the liquid as slowly as desirable with the result that a considerable loss of propane to gas occurs.

2. Production of liquid petroleum gas products from 3 columns.

In a discussion of the production of liquid petroleum gas products from two columns above, it was noted that difficulties of condensation and propane product recovery are encountered in the primary column due principally to the presence of dissolved methane and ethane. This is particularly significant in plants employing high pressure absorption because the concentration of methane and ethane in the wild gasoline is considerably higher than in the case of low pressure absorption plants. The data below illustrate analyses of typical wild gasoline feeds to stabilizers from absorption plants operating at about 60 lb. pressure and 475 lb. pressure, respectively:

Component	Analysis of Wild Gasoline, liq. vol. % 60 lb. Absorption	475 lb. Absorption
Methane, CH_4	0.2	0.9
Ethane, C_2H_6	0.8	8.9
Propane, C_3H_8	8.0	34.7
Isobutane, i-C_4H_{10}	6.3	7.9
Normal butane, n-C_4H_{10}	22.8	21.8
Isopentane, i-C_5H_{12}	4.0	9.9
Normal pentane, n-C_5H_{12}	4.0	4.8
Residue, C_6+	53.9	11.1
Total	100.0	100.0

These figures show that, based on equal volumes of propane, the high pressure wild gasoline has a methane concentration equal to the low pressure gasoline, and an ethane concentration 2.6 times as high. It follows, therefore, that the overhead from the primary stabilizer column consisting of propane and lighter will be condensed with more difficulty in the case of the gasoline containing the larger percentage of methane and ethane. To offset this difficulty a third column often called a de-ethanizer is sometimes used. Figure 8 diagrammatically shows the installation of such a column in conjunction with a depropanizer and a debutanizer set-up for the production of liquid petroleum gas products. In this case wild gasoline feed from the accumulator tanks is pumped to the primary tower which in this case is a de-ethanizer and which operates at a pressure of 500 to 600 lb./sq.in. The overhead from this tower consists of ethane, methane, and a trace of propane.

(To be Continued)

Field Development

Los Angeles Basin

Birch Completes Brea Producer

Birch Oil Co. completed its No. 16 at Brea pumping 85 bbls. of 22 gravity oil from two open intervals between 3020 and 3368 ft. If production holds up satisfactorily, the company plans to drill three more wells on the property.

Puente Wildcat Flows Water, Gas

While standing idle at 2768 ft., The State Co.'s Rowland No. 1 surprised its owners by voluntarily starting to flow fresh water and gas with a trace of heavy oil. The volume of water was estimated at 10,000 bbls. a day while the gas rate appeared to be about 200,000 cu. ft. daily. Tests showed the water to contain 35 grains of salt per gallon and the gas to have a relatively small ethane percentage.

No casing is in the hole with the exception of surface pipe set to 317 ft. A non-commercial tar sand was encountered at 1000 ft. but the sources of the water and the gas remain unknown. Temporarily, the well is standing shut-in with 50 lbs. pressure registering on the casing head gauge.

Basin Drills Potrero No. 12

Basin Oil Co. is drilling its No. 12 on the Potrero Country Club property below 2900 ft. No. 10 flowed 185 bbls. of 50 gravity oil from 3800 ft.

Activity Scattered At East Coyote Field

Activity at East Coyote at present is scattered widely, there being no "hot spot" in the field. At the extreme west end, Union Oil Co.'s Toussau No. 2 is standing plugged to 7227 ft. after locating the water entry at the top of the old plug at 7503 ft. Near Brea Canyon road, Standard Oil Co. is sidetracking a fish in Coyote No. 2-10 with bottom at 5978 ft.

On the north side of the field, California National Oil Co. is preparing to set casing in its Well No. 1 as soon as weather permits. Redrilled bottom is 3405 ft.

Carlton B. Wood has taken over the drilling of the Adco Petroleum Co. Basten No. 1 near Carolina St. and is deepening below 2500 ft. The well adjoins the Master Petroleum Co. wells which were successful in developing 4200 ft. production last year.

Fred Garliepp is planning to recondi-

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Athens	Rankin & Williams	1	7, 3-13	9098	Fishing D.P.
	Barnsdall Oil Co., Honor Rho A-17-1		5, 4-16		Grade
Castaic	Colter, R. T., Explor.	1	8, 4-17	1350	Drilling
	Jasper, Fred S.	1	17, 4-17		Location
	Morse-Manigold, Inc., McDermott	1	26, 5-17		Grading roads
	Western Gulf Oil Co., Lechler	2	31, 5-17		Location
	Worland Oil Co., Jenkins-Owens	1	18, 5-16	2940	Idle
Dominguez, West	Hiles Drilling Co., Grant	1	29, 3-13	7660	Rigging up
	Wood-Mellon Oil Co., Wood	1	31, 3-13	7498	Prep. to test
Malibu	Sovereign Oil Corp., Sovereign-Marblehead	1	7, 2-18	3872	Idle acct. rains
Newhall	Lee, Wm. Y., Irene	1	31, 4-15	300	Idle
	Purman, Thos. H. T., Needham	1	13, 3-16		Grade
	So. Calif. Drlg. Co., Needham	4	13, 3-16	4398	Prep. to perf.
	The Texas Co.	1	14, 3-16		Location
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	6580	Idle
Puente	The State Co., Rowland	1	14, 2-10	2768	Shut in gas
Redondo	Silver Circle Oil Co., Cal-o	1	18, 4-14	3464	Idle
	Pettijohn, J.E., Dominguez Estates	1	5, 4-14		Grade
	Orange County				
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	5649	Idle
Kraemer	Valley Petroleum Co., Kraemer	1	25, 3-9	604	Idle
	San Bernardino County				
Carbon Canyon	May, Homer, Oasis	1	31. 2-8		Rig

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Contra Costa	Lafayette Oil Co., Morris	1	28, 1n-2w		Location
Humboldt	Daly, M. B., Jr.	1	2, 1n-2e		No report
Madera	Blake, T. N., Arnold	1	22, 10-17	3204	Idle
Merced	Don Pedro Oil Co.	1	9, 6s-9e	1906	Idle
Mendocino	Keyt, N. F.	1	3, 12n-17w	220	Drilling
Monterey	Loma Grande Oil Co., Corey	1	23, 24s-10e	2175	Idle
	Priest Valley Pet. Co., Greve	1	22, 20s-12e	2885	Idle
Sacramento	Harkness, Tracy	1	35, 8n-4e		Rig
San Joaquin	Standard Oil Co., Blewett	2	25, 3s-6e		Location
San Mateo	Ra-Lite Petroleum, Inc., Bell	5	16, 7s-4w	1200	Idle
Yuba	Wright, L. G., Cox	1	18, 14n-5e	1795	Cleaning out

tion and test the old Carlton Community No. 1 well drilled by Continental Oil Co. five years ago.

Two Wells Drill Del Valle Field

R. E. Havenstrite, Operator, now has two strings of tools working in the Del Valle field. Vasques No. 1 is making hole below 4000 ft. on the south side of the productive area while Lincoln No. 3 is yet above the 2000 ft. mark.

Universal Consolidated Oil Co. plans to install equipment soon in Dennis No. 1, derrick for which was built last month.

Acoma Completes Wilmington Outpost

Of great importance to the future of the northwesterly extension of the Wilmington field is the Acoma Oil Co. well now completing south and east of the intersection of Figueroa St. and State St. A single string of casing was landed on bottom at 3762 ft: and cemented at the top of the perforated interval at 3550 ft. leaving open the Upper Terminal zone of the main portion of the field. The sands appeared to be well saturated and prospects are good for production in the 100 to 200 bbls. a day range.

Several operators plan development work in this area in the immediate future and if the Acoma well exceeds expectations, much drilling will ensue.

Wildcat Planned For Whittier Area

Los Nietos Valley Oil Co., newly formed in Whittier, is planning to drill an exploratory well in the Whittier-La Habra area. The exact site of the test could not be ascertained as the leasing program will not be completed for another week or two.

Texas to Drill Newhall Wildcat

The Texas Co. has started preliminary work for its Newhall wildcat near Highway No. 99. The company has held leases in this area for some time but delayed development until the present while gathering all possible geological information.

Site of the test well is in sec. 14,3-16, approximately 3500 ft. southerly from British-American Oil Producing Co.'s Edwina No. 1 and 4000 ft. southwesterly from Needham No. 4 which was carried to 4398 ft. by Consolidated Petroleum Co. Both of these wells found numerous oil showings, British-American having made a series of unsatisfactory tests in its 6196 ft. well and Consolidated making a pumping trial which resulted in a little oil recovery.

It is believed that The Texas Co. play is based on the pinching out of the Miocene and the possible accumulation of commercial oil in a stratigraphic type trap. Lower Eocene sand found in the Consolidated project contained oil but was too tight to produce in quantity. The sands found by British-American were very much looser but no oil was in evidence during the tests.

In an effort to recomplete in the established shallow zone, Southern California Drilling Corp., original lessee of the Needham property, is plugging and perforating casing in No. 4 This well was drilled by Southern California Drilling Corp. to the upper Eocene sand some years ago and was deepened last year by Consolidated.

Weather Retards Castaic Development

Heavy rains delayed plans of several companies in the Castaic region. Barnsdall Oil Co. was unable to keep its newly

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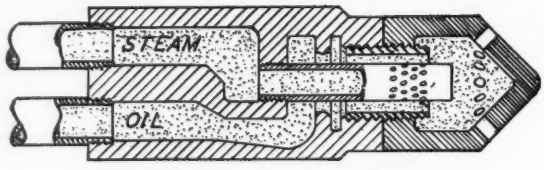

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built roads open to Honor Ranch No. A-17-1, location for which was graded in sec. 5,4-17.

Western Gulf Oil Co. surveyed a site for Lechler No. 2 in sec. 31,5-17 but for several days was unable to get on the ground. No. 2 will be drilled about 1500 ft. northeast of No. 1 which is now pumping 50 bbls. a day of 22 gravity oil from 2400 ft.

Morse-Mangold, Inc., when weather permits, are building a road for McDermott No. 1 which will be spotted near the east quarter corner of the southwest quarter of sec. 26,5-17. Production will be sought at medium depths.

So far, Fred S. Jasper has been unable to start his projected test in sec. 17,4-17 west of the Del Valle field. Pedro Petroleum Co. is planning to deepen its wildcat which was suspended last year.

Huntington Beach Gets Good Producers

A number of good new wells have been completed recently at Huntington Beach with Signal Oil & Gas Co. getting the lions share. Largest of the new crop was Signal's Bolsa No. 22, finished in the upper zone at 3405 ft. for 1120 bbls. of 29 gravity oil. Second in productivity was No. 22-A, which made 612 bbls. of 27 gravity crude from the lower zone at 4451 ft. Other wells brought in by Signal were No. 1 for 190 bbls. and No. 1-A for 195 bbls. The company is preparing to complete No. 2-A and is drilling No. 23-A.

Surprisingly good production was obtained by Pacific American Oil Co. after redrilling No. 4 on the Encyclopedia property in the Old Field. With 93 ft. open to bottom at 3890 ft., production runs about 135 bbls. a day after deducting a 20% cut.

Southwest Exploration Co. finished its 35th well beneath the ocean pumping initially 340 bbls. a day. Hole was bottomed at 4761 ft.

Harold C. Morton is preparing to spud in his No. 2 well on the Tide Water Associated Oil Co. Fowler lease. His first try here was good for better than 100 bbls. a day.

Near the intersection of Summit and Crystal Sts., V. R. G. Wilbur is planning to drill Twining No. 3.

Bush Oil Deepening Inglewood Outpost

Without making a formation test of the 73 ft. open below the casing shoe at 7920 ft., Bush Oil Co. started coring ahead in the Federal Oil Co. Smith No. 1 at the north end of the Inglewood field. Presumably the well is seeking the permeable sand bodies found barren in the Standard Oil Co. L.A.I. No. 3-1 at a structurally lower location on the west flank. The Federal well being approximately 300 ft. higher, it is hoped the sands will be found saturated with oil.

Although high gas pressure interfered with drilling considerably below 7940 ft. before setting casing, no gas was in evidence during the water shut-off test and none showed in the mud as the hole was cleaned out to core ahead.

Standard's deep test is now coring below 9250 ft. in gray sand.

Deep Signal Hill Test Proves Disappointment

Union Oil Co.'s Signal Hill deep test, L.B.C. No. 19, was something of a disappointment when it failed to flow after a week's swabbing. A Kobe pump is being installed in an effort to obtain commercial production.

Drilled to 10,894 ft., the hole was plugged to 10,582 ft. and 7 in. casing cemented at 9657 ft. No. 19 is the deepest well ever drilled in the Long Beach field.

Royalty Service Corp. apparently has some kind of a well in I.C. No. 1 on California Ave. a block south of Wardlow Road. With 200 ft. open to plugged bottom at 6540 ft., the well swabs and flows by heads at a 100 bbl. rate of relatively clean oil. It is planned to install a pumping unit.

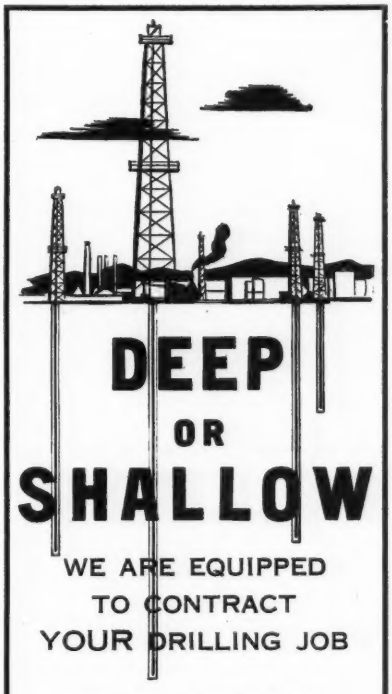
Success of Hilldon Oil Co. is recompleting Pool No. 1 for 300 bbls. after deepening to 5614 ft. has occasioned a renewal of activity in the northwest extension area. Union Oil Co. is preparing to deepen Oil Operators No. 4 while Richfield Oil Corp. is getting under way with Bixby No. 4. Hilldon is already deepening Pool No. 2.

That the deepening and reconditioning campaign may develop into one of large proportions is seen in the fact that Shell Oil Co., long inactive at Long Beach, is working on two jobs after getting 94 bbls. cutting 0.2% in its first, Pickler No. 6. The company is also starting a new well on the Alamitos lease. General Petroleum Corp. is working-over Clock No. 5 near Willow St. and Orange Ave. and Richfield Oil Corp. plans to redrill Connet No. 1 on Reservoir Hill. The Texas Co. is drilling Harlow-Kent No. 18 and has location staked for Robinson No. 6.

Many independent companies are either reconditioning wells or are planning to do so in the near future. One of the best jobs finished recently was Incorporated Production Co.'s King Tut No. 1 located north of the cemetery. Redrilled to 2888 ft., the well was finished in the upper Wilbur zone pumping an estimated 140 bbls. cutting 50.0%. The water content was dropping.

Union Oil Co. Tests Deep Dominguez Well

Union Oil Co. is preparing to test for production in Callender No. 79, the deepest well ever drilled in the Los Angeles Basin. With the hole plugged from 12,720 ft. to 10,314 ft., 5½ in. casing was landed and cemented at 10,010 ft., the top of the perforated interval. As the sands were quite impermeable, no great hopes are held for large production.



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San Joaquin Valley

Volume Increases in Union Ave. Well

Hancock Oil Co.'s Roberts No. 1 on the Union Avenue Plunge property in sec. 6,30-28, at the southerly limits of Bakersfield, at last report had built up and was pumping 180 bbls. of clean 15 gravity oil daily. The well was finished at 5593 ft., plugged to 5340 ft., and completed from the interval 5282 ft. to 5312 ft. pumping a 98 bbl. rate. Coming from what appears to be a good reservoir, the discovery bids fair to be an important addition to California fuel oil stocks, for like much of the east Valley production the oil contains no gasoline. A laboratory analysis of the production breaks down like this:

Gravity	14.7°
M&BS (Benzol)	2.1%
Water by distillation	1.5%
Sulphur	1.48%
Flash, P. M.	120°F.
Gasoline	NONE
Initial boiling point	400°F.
Viscosity	383
Pour point	25

While well No. 1 has had some sand trouble it is apparently not considered too troublesome since the company is already drilling No. 2 at 2460 ft. Though the acreage around the strike is in many hands, it is thought possible that development will be slow in order to carefully determine the area of the productive sands.

Bankline Drilling Maricopa Core Hole

Three miles southeast of the southerly tip of the Midway-Sunset field, in sec. 24,11-23 on the Maricopa slopes, Bankline Oil Co.'s No. 24-24 is drilling at 900 ft. Actual drilling is being done under contract by Hall-Baker Co. which is employing mast-type portable equipment on the exploratory hole. Other shallow holes have been drilled in the section, some of which reported oil showings.

Union Oil Plans New McClung Try

The McClung area of Kern county, long an enigma in oil exploration circles, is again to be tested. Latest of a series of deep tests along a trend southeasterly from the Greeley oil field, the current try, Union Oil Co.'s Kernco No. 31-3, is the fourth project in sec. 3,30-26. While intended as a Vedder zone try, it will probably test in passing the Stevens sands which Superior Oil Co. found momentarily productive in 1937 while drilling KCL No. 9 a half mile to the east.

A little more than a half mile east of the new well, Superior Oil Co.'s KCL No. 12 bottomed at 13,131 ft. after finding the Vedder barren at 11,126 ft. Two miles south of this try, along the same general trend, Continental Oil Co.'s KCL No. D-2 in sec. 14,30-26 found the Vedder barren at 13,260 ft. and abandoned in shale at 14,051 ft. A little over a mile northwest of Union's location, and still on a line with Greeley production, Superior Oil Co.'s Brandt No. 1 in the southeast corner of sec. 28,29-26, found the Vedder barren at 11,740 ft. and abandoned at 11,761 ft.

Other wells have been drilled in the area in search of the Stevens zone production which so mysteriously vanished from the mentioned KCL No. 9. This well, located near the northeast corner of sec. 3,30-26, was drilled by Superior Oil Co. in 1937 to a depth of 7870 ft. after finding the Stevens zone at 7565 ft. With a full string of 7 in. casing in the hole, and gun perforated from 7558 to 7580 ft., the well was swabbed in October 14 flowing 850 bbls. rate of clean 33 gravity oil. After an hour's flow, mud broke in and the well died. Swabbing operations failed to re-establish production and a gas-lift was installed which succeeded only in producing a small amount of fluid cutting 52% with no free water.

Following this disappointment Superior moved one location southwesterly and drilled No. 10 to 8403 ft. without encountering oil sands of any kind. Resolving to again attempt completion of No. 9, the hole was redrilled to 7800 ft. where a formation test from 7550 ft. to bottom recovered only mud and salt water.

All wells drilled in the area have encountered sands in some of the Valley's

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Cantua Creek	The Texas Co., S. P.	27–13	13, 17-15	8626	Drilling
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13	791	Idle
Mendota	Jergins Oil Co., Cheney Ranch	1	29, 14-13	9345	Idle
		2	28, 14-13	7354	Flowing gas
	Kern County				
Belridge—South	Santa Mora Oil Co.	1	10, 28-20	544	Prep. to deepen
Buttonwillow	The Texas Co., S. P.	47–15	15, 29-24	7956	Sidetracking
Devils Den	Herzog, R. D., Collins	1	26, 25-18	30	Idle
	Herzog, R. D., Marine	1	26, 25-18	708	Idle
Edison	Goodrum & Vincent, Inc., S. P.	7	31, 29-30	460	Idle
	Kern Valley Drlg. Co., Williams	1	30, 30-30	525	Drilling
Grapevine	Continental Oil Co., Tejon	A-1	28, 11-19		Location
	Kern Line Oil Co.	1	19, 11-19	8290	Prep. to deepen
	Richfield Oil Corp., Tejon Ranch	1	2, 10-19	10464	Drilling
Lost Hills	Randan Pet. Corp., Theta	1	3, 26-20	1625	Idle
Maricopa	Bankline Oil Co., Well	24–24	24, 11-23	900	Drilling
McClung	Union Oil Co., KCL	31–3	3, 30-26		Foundation
McKittrick	Smith, Ebert E., Smithhart	1	34, 30-22	2278	Idle
Richgrove	Borget, A. J., Kendall	1	16, 25-27	430	Idle
	Bolling Oil Co., Quinn	2	14, 25-27	1120	Drilling
	Copeland, F. B., Thomas	1	15, 26-27	2383	Drilling
	Shell Oil Co., Smith	77–11	11, 26-27		Location
Round Mountain	Spartan Drlg. Co., Hiatt	1	32, 28-29	2085	Idle
Shafter	Continental Oil Co., KCL	C-2	35, 27-24	9898	Drilling
Strand	Tide Water Assoc. Oil Co., KCL	56-8	8, 30-26		Location
Union Avenue	Hancock Oil Co., Roberts	1	6, 30-28	5593	Pumping
	Hancock Oil Co., Roberts	2	6, 30-28	2898	Drilling
Wheeler Ridge	Richfield Oil Corp.	KCL 2	28, 11-20	11681	Abandoned
	Kings County				
Kettleman So. Dome	Bristol Oil Co., Smith	1	35, 24-19	8054	Testing
Pyramid Hills	Chanslor-Canfield Midway Co., Bocquarez	1	17, 24-18	1245	Stdg. plugged
	Pyramid Prod. Co., Spreckles	2	16, 24-18		Rig
	Tide Water Assoc. Oil Co., West Slope	76	20, 24-18		Rig
Reef Ridge	Blair Oil Co., Blair	1	24, 23-16	985	Idle
	Tulare County				
Terra Bella	Arnold, V. F., T.B.I.D.	1	5, 23-28	105	Idle

productive zones, but only this once, and only in this zone, has free oil actually been recovered.

Mount Poso Wells Continue Active

At the west flank of the north section of the Mount Poso pool, Shell Oil Co. is grading to drill Matthew Fee No. 8 near the west quarter corner of sec. 4,27-28. With the Vedder as the objective, the test is being put down as a trial well to determine the productive limits of the field at this point. Believed to be some 50 ft. lower on structure than the nearest wells on the lease, the site is thought to be higher than wells producing even further west at the southerly edge of the pool.

Southeast of the Dominion pool in the Mount Poso area, Da-Me Oil Co. is rigging up to drill Well No. 2 near the west quarter corner of the southwest quarter of sec. 27,26-28. The current try is near isolated Vedder zone production which was discovered by Recovery Oil Co. and Italo Petroleum Co. some years ago.

Two and a half miles east of this well in sec. 36,26-28, Signet Oil Co.'s try at production is yet idle at 775 ft. after finding granite at 590 ft.

Trico Finishes Round Mt. Well

Trico Oil & Gas Co. finished Coffee No. 5 flowing an estimated 50 bbls. of 17 gravity clean oil and 1,000,000 cu. ft. of gas from 81 ft. of Vedder zone to bottom at 1286 ft. Located in sec. 8, 28-29 the well is the latest of a series in a small pool discovered by the company late last year.

Bolling Spuds Richgrove Try

R. S. Bolling's Quinn No. 2, in sec. 14, 25-27 of the Richgrove area, was last reported in sand and clay at 950 ft. Located near the center of the section, the try is an attempt to find production suggested by the showings made by Dilamar Pet. Corp.'s Quinn No. 1 in section 15 during 1938. This well pumped 10 gravity oil at a 60 bbl. rate from 2880 ft. for a few days before water finally took over the well. Subsequent wells in the area found showings but none actually produced oil since that time.

At the southerly edge of the Richgrove area, Shell Oil Co. is preparing to drill Smith No. 77-11 as a shallow Vedder test in the southeast corner of sec. 11,26-27. Only other well in the section was Superior Oil Co.'s Smith No. 1 in the northwest corner, which drilled to 3446 ft. in 1927. Barren Vedder was found here at 2485 ft., the Walker at 2965 ft. and the granite basement at 3414 ft.

In sec. 15,26-27, Petex Drilling Co. contracting for F. B. Copeland, last report was in shale at 2350 ft. with Thomas No. 1.

Buttonwillow "Cat" Sidetracking Fish

The Texas Co.'s S.P. No. 47-15 in sec. 15,29-24, a try for a deep production closure in the Buttonwillow area, is sidetracking a drill pipe fish at 3525 ft. after once bottoming at 7956 ft. Sands found in earlier tries ranged down to 12,000 ft. but were too tight to produce.

Edison Try Again Working

Kern Valley Drilling Co.'s Williams No. 1 in sec. 30,30-30 southeast of the Edison field is again drilling. The job, under contract to Mack Drilling Co., at last report had reached 510 ft.

In the Edison Area proper, Wood-Callahan's Heyden No. 2 in sec. 21,30-29 has set 8⅝ in. casing and is standing cemented with bottom at 3645 ft. in oil sand and shale.

Activity Predicted For Kern River Field

While at present only Ray Frampton's No. 3 in sec. 27,28-28, at the easterly flank of the Kern River field is active, there is a recurrence of shallow drilling and reconditioning in the offing for this important fuel oil producing field.

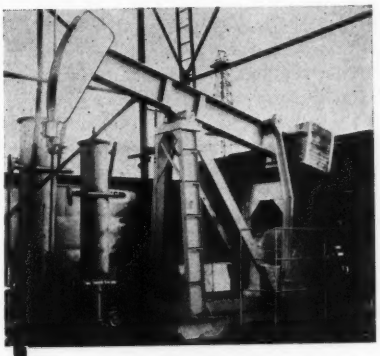
Predicated largely upon an increased demand for additional fuel oil, which is proven by the late substantial withdrawal of such stocks from storage, the probability of such a program is further strengthened by an ever increasing murmur among heavy oil producers for a raise in heavy oil price schedules.

In the event such price revision is effected, it inevitably follows that wells long idle, will be conditioned to produce the allotments heretofore unexercised. In this area a great deal of water must also be raised to obtain the heavy oil typical of the field, an operation only practicable in large volume when prices are commensurate with lifting and marketing costs.

It is reported that Tide Water Associated Oil Co. already has such a plan under consideration which will involve hundreds of the shallow jackline pumpers. Standard Oil Co., Chanslor-Canfield Midway Oil Co. and Kern Oil Co. are among the other large lease holders in the field, although a great deal of acreage is held by smaller independent operators.

The 1895 wells in the field receive a daily allowable of 7019 bbls. of which only 3857 bbls. is produced. Since slightly more than 900 wells are shut in and have been for a period of years, it is apparent that such a development program will provide considerable impetus to the well servicing and equipment business.

The facts surrounding the proposed development here are by no means limited to this field, since many in the Valley



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are similarly situated. Shell Oil Co. has already opened a comparable program in the Mount Poso area by starting Matthew Fee No. 8 to further develop the fuel and lube oil producing sands found in the Vedder all along the east Valley hills.

Ohio Completes Paloma Well

Productive limits of the Paloma field were pushed a quarter of a mile to the west when Ohio Oil Co. finished KCL-A No. 9-83-4 near the east quarter corner of sec. 4,32-26. Bottomed at 10,340 ft. the well found the top of the Stevens zone oil sand at 10,001 ft., 63 ft. lower than nearest production.

Consistent with the production history of the yet young field, the recovery was largely high gravity condensate from high pressure gas sands. The initial flow was measured at 1220 bbls. of 52 gravity clean oil through a 48/64 in. orifice while the gas metered at 8,300,000 cu. ft.

With this completion, sole drilling activity in the field is vested in Western Gulf Oil Co.'s outpost, KCL No. B-12-12 now coring at 10,755 ft. Located a mile southeast of former field limits, near the northwest corner of sec. 12,32-26, the well already demonstrated the ability to produce high gravity oil by making 52.2 gravity condensate at a 572 bbl. rate on formation test of the interval 10,220 to 10,534 ft. Gas was measured at a 3,930,000 cu. ft. rate. Cored ahead in an effort to clarify the position in the geologic section, the well has thus far marked almost solid oil sand from 10,248 to 10,429 ft. and oil sand and shale from 10,430 to 10,691 ft. where hard shale was entered which carried to present bottom.

NW Greeley Area Active

Vedder zone development at the northwest flank of the Greeley field is brisk. The last week, General Petroleum Corp. finished Wallace No. 2 flowing 405 bbls. of 38 gravity oil on a 10-hour gauge, with gas measured in the same period at 355,000 cu. ft. General Pet. Corp. also bottomed Oughton No. 3 and Sullivan No. 3 in oil sand at the customary 11,510 ft. mark. Top of the Vedder here is found near 11,460 ft. These wells will be completed within a matter of a few days. The company is rigging up to drill Mitchell No. 1, while Oughton No. 4 is temporarily idle at 3625 ft.

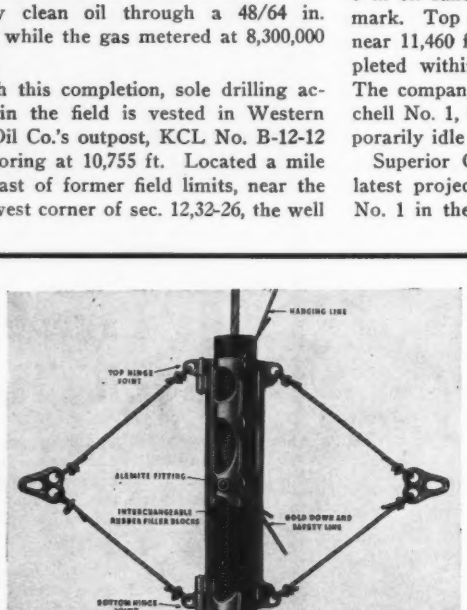
Superior Oil Co. is excavating for its latest project in the area, D. O. Moore No. 1 in the southeast quarter of sec. 1, 29-25. In the same quarter section Wilshire Oil Co.'s Campen No. 1 is still shut in after completing from 11,500 ft. for 3500 bbls. of clean 34.6 gravity oil. A perfect gas-oil ratio of one to one was obtained when the gas flowed at a 3,500,000 cu. ft. rate.

Standard Oil Co. is also busy in the area with three strings digging at intermediate depths and one rigging up.

Kern Front Well Makes Good Flow

Near the south line of sec. 11,28-27 in the northerly section of the Kern Front field, McDonald & Dearin's well No. 7 obtained a surprisingly good yield from sands thought materially depleted. With 10¾ in. water string cemented at 1630 ft. an 8⅝ in. liner including 170 ft. of perforations was landed on bottom at 1830 ft. With 3 in. tubing hung at 1400 ft. the well made 150 bbls. of 14.0 gravity oil cutting only 10% water.

Pet peeves of more than 5,000 motorists, as indicated by a recent poll, are: Road hogging, 1,559; drivers cutting in 1,162; careless pedestrians, 651; inadequate direction signs, 643; no place to park, 601; failure to signal, 412; roadside ugliness, 283.



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Coastal District

Torrential Storms Hamper Coast Work

Development work in many coastal areas was virtually halted by the torrential rains of the past two weeks which caused damage that in some instances will require many days to repair. Drilling is virtually at a standstill throughout Ventura County because of road conditions.

Huasna Wells Test Heavy Oil Horizons

Seriously hampered, but not altogether shut down by the weather, "Tex" Harvey Oil Corp. perforated 7 in. casing in Gilmore Community No. 1 from about 3170 to 3280 ft. A pumping test is said to have resulted in the recovery of 25 bbls. a day of 14 gravity oil and some water. With the hole open from the casing shoe at 3530 ft. to bottom at 4518 ft., production was water with a little 22 gravity oil.

"Tex" Harvey's second Huasna Valley test, Gilmore Community No. 2, has reached a depth in excess of 2200 ft. in its quest for the Vaqueros formation not reached in No. 1. After setting surface casing at 950 ft. a bailing test was made to determine the potentialities of the shallow Brown Shale zone. Only a little heavy oil entered the hole.

Petrol Extends Gato Production

Production of The Petrol Corp.'s Tognazzini No. 3-15, which extended the Gato Ridge field some distance to the southeast, has been slowed to 70 bbls. a day of 11 gravity oil cutting 16%. About 2000 ft. of formation is open to bottom at 4700 ft. According to unverified rumors, there will soon be more drilling in this area due to the increased demand for heavy oils.

Union Oil Active At Santa Maria

As fast as weather permits, Union Oil Co. is going ahead with the two new projects scheduled for the old Santa Maria field. In sec. 26,9-34, Cal-Coast No. 19 is nearly ready to spud in while in sec. 24, foundations are completed for Dome No. A-15.

At the west end of the Santa Maria Valley field, Union Oil Co. finished Moretti No. 3-1 as an excellent producer. With bottom at 5275 ft., the well flowed initially 1304 bbls. of 16 gravity clean oil through a 22/64 in. orifice. The company's Fleisher No. 1, an attempt to extend the producing area to the southeast, pumped only water and remedial measures are being taken. Stinson No. 2 is drilling at 4000 ft.

Production Sought Near Summerland

Three miles north of Summerland, L. E. Stokes is preparing to explore for shallow production in sec. 1,4-26 near the tunnel from which the city derives its water supply. It is said the recovery of oil skimmed from the water produced in the tunnel has increased to about 20 bbls. a day.

Alliance Pet. Starts New Ventura Avenue Well

With Hartmann Ranch No. 3 drilling at 2250 ft., Alliance Petroleum Corp. is preparing to build derrick for Hisey No. 4 at Ventura Avenue according to President Lyman C. Hisey. The new well will adjoin Hisey No. 3, completed by the company in April of 1939 with initial production bettering the 2000 bbl. mark even though restricted through a 38/64 in. bean. After nearly two years, capacity of the No. 3 well is still over 400 bbls. a day.

Another good well was obtained by British-American Oil Producing Co. in well No. 11 on the Bolsa Chica Oil Co. Hartmann lease. With perforations open from 8125 ft. to bottom at 9111 ft., the initial yield was 693 bbls. of 29 gravity oil cutting 10% and 238,000 cu. ft. of gas. The company plans to drill No. 12 in the near future.

Lloyd Corp., Ltd. is drilling below 6800 ft. in well No. 7 and is rigging up to spud No. 8.

On the large Taylor lease in the westerly section of the field, Shell Oil Co. finished No. 129 with a 1500 ft. interval open to bottom at 9862 ft. Production gauged 1300 bbls. a day of 31 gravity oil and 975,000 cu. ft. of gas. On the same property, Shell previously completed No. 132 with a potential of 2712 bbls. and 2,260,000 cu. ft. of gas from 8255 ft.

Tide Water Associated Oil Co. has four strings of tools now working and is preparing to drill another well on the McGonigle lease on the north flank of the structure.

Rincon Deep Test Drills Below 4350 Ft.

Scheduled as a deep test of the central portion of the Rincon field, Chanslor-Canfield Midway Oil Co.'s Hobson No.

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
	Santa Barbara County				
Goleta	Coates, Spencer D., Hollister	2-A	3, 4-29	1570	Idle
	Del Mar Oil Co., Rowe	1	11, 4-28		Rig
Summerland	Stokes, L. E., Glenray	1	1, 4-26	90	Idle
	San Luis Obispo County				
Huasna	Tex Harvey Oil Corp., Gilmore Comm.	1	11, 32-14	4518	Idle
	Tex Harvey Oil Corp., Gilmore Comm.	2	11, 32-14	2200	Idle
	Ventura County				
Bardsdale	Hopland Oil Co.	1	1, 3-19	985	Idle
	Palma Oil Co., Elkins	1	8, 3-19		Grade
Conejo	Sulphur Springs Oil Co., Janss	1	33, 2-19	4526	Idle
Ojai	Seaport Oil Corp., Arnett	3	15, 4-21	2532	No report
	Per-Col Oil Co., Anlauf	6	21, 4-21	2105	Idle
Oxnard	Bender, E. A., Farrell	1A	5, 1-22	7005	Idle
Piru	Nelson, D. V., P.F.C.—C.H.	1	19, 4-18	1293	Drilling
	Havlin & Pottenger, Alice	1	33, 4-18		Rig
	Oilexco, Inc., Newhall-Land	2	2, 3-18	570	Idle
	Oilexco, Inc., Stevens	1	34, 4-18	373	Idle
Sespe	Inter Counties Fuel Co.	1A	22, 4-19	510	Idle
	Signal Petroleum Co., Hadley	7	13, 4-19	2900	Idle
South Mountain	Bolling Oil Co., Schieferle	1	17, 3-29		Cellar
	Calif. Securities Oil Co., Schieferle	1	17, 3-29	4501	Pumping water w/ trace oil
	Comstock Pet. Co.	1	17, 3-29	1800	Idle
	South Mountain Oil Co.	1	10, 3-20	1100	Drilling
Sulphur Mt.	Madison Oil Co., Delphy	1	24, 2-22	2500	Idle
Timber Canyon	Fletcher, A.B., Timber Canyon	3	18, 4-20	1360	Idle
	Johnson, Chas, P., Jr.	1	24, 4-21	85	Drilling

C-9 is drilling below 4350 ft. Results of this test will have an important bearing on reserves and ultimate recovery of the field.

On the north flank of the structure near the southeast corner of sec. 8,3-24 Richfield Oil Corp. is preparing to drill Hobson U. S. No. 3 to the Miley zone.

C. C. M. O. Co. recently finished Hobson No. B-40 in the southeast extension area pumping 75 bbls. of 30 gravity oil cutting 10%. Casing was perforated at intervals from 4820 ft. to bottom at 5500 ft. The company is preparing to redrill No. B-16.

Sandalyzer Proves Effective Mud Screen

When R. E. Havenstrite, Operator, discovered the Del Valle field by bringing in his Lincoln No. 1, visitors who gathered at the rig to watch the final drilling stages noted the operation of a new type of equipment. This was a drum-shaped mud screen, known as a Sandalyzer, which separated sand as well as formation fragments from drilling mud through the combined effects of rotation, vibration and hydrostatic head of the mud fluid itself.

E. C. Lovell, who is widely known throughout California oil fields as "Clint", is the head of E. C. Lovell Mfg. & Sandalyzer Co., whose new home at 6309 Paramount Blvd., Long Beach, is pictured on this page, and has been making and selling oil field equipment since 1913. "Clint" describes the Sandalyzer as follows:

"The complete Sandalyzer weighs 2600 pounds and occupies a floor space 4 feet by 7 feet. It is made of metal throughout. The rotating, vibrating drum is 5 feet in diameter by 3 feet long, wound with .016 stainless steel spring wire 25,000 feet long under 40 lbs. pull, giving 38 wires to the inch and openings of .010.

"The design is such that a well cleaned deck of 11 square feet is presented to the mud every 15 seconds. Mud is kept continually agitated, none is wasted in eliminating rejects, and there is no dilution from screen cleansing water. Power is supplied by a 5 h.p. electric motor which takes considerably less wattage after starting.

"In spite of the high capacity of the Sandalyzer, effectively handling as high as 900 gallons per minute, maintenance costs have been extremely low because of the sound design and strength of the screen deck, and the effective bearing and lubrication arrangement. All parts are readily accessible if replacement should become necessary, and damage which might occur to the screen is quickly repaired by the simple use of a soldering iron. The entire screen can be wound on a drum in a few hours."

Frank F. Dickey Dies In Pasadena Hospital

Frank F. Dickey, Western sales representative of A. O. Smith Corp., died Feb. 11, in a Pasadena hospital. Mr. Dickey, who was born in Fresno 45 years ago, was formerly assistant manager of Western Pipe & Steel Co. in Los Angeles. His association with A. O. Smith Corp. began seven years ago.

Emsco D+B Division Holds Open House

The D+B Division of Emsco Derrick & Equipment Co. held an open house at their Taft Branch on Fellows Highway. The occasion served a twofold purpose—celebrating the dedication of the remodeled D+B building with its new and additional equipment for the betterment of pump service, and to commemorate approximately twenty-five years of service to the oil trade in the Midway District.

Under the able direction of Clarence Phillips, district manager and Don K. Drenk, field salesman, hosts for the day, employees and visiting representatives of oil companies in the Midway district, were conducted through the entire shop and given an opportunity to inspect a special display of recent innovations in pump design and the new, modern D+B equipment just installed to efficiently service oil well pumps.

All agreed the event was a great success and in view of the exceptional interest demonstrated in the exhibits, Mr. Phillips advises that the display is being held over in the spacious lobby of the D+B Store for an additional thirty or sixty days and is open for inspection of all those interested in the latest developments in pumping equipment.

Martin-Decker Changes Territory Coverage

Martin-Decker Corp., Long Beach, Calif., has announced changes in the territories covered by two of its Mid-Continent factory men.

Jack Clemens, located at Corpus Christi, Texas, will henceforth include Houston and vicinity in his territory. Dave Waters, formerly working out of Houston, will cover North Texas and the states of Oklahoma, Kansas and Illinois for the company. Both men will install and service all types of Martin-Decker Weight Indicators, Gauges and Recorders on wells in their respective districts.

Lane-Wells Acquires Olympic Packers

According to an announcement made February 10 by Rodney S. Durkee, president, Lane-Wells Co. has purchased the patents, packer and liner hanger stocks, and good will of the Olympic Products Co. of Los Angeles and Houston, makers of Olympic Packers and Liner Hangers. The newly acquired line of tools will be known as Lane-Wells "Olympic" Packers and Liner Hangers and will be sold through all of Lane-Wells Branch offices in the Gulf Coast, Mid-Continent and California oil fields. Manufacturing will be done in the company's Los Angeles plant. Stocks of packers and parts will be carried in each of the Division Headquarters.

Lane-Wells Company is one of the largest manufacturers and distributors of oil and gas well packers. In addition to the new "Olympics," Lane-Wells complete line of Packers and Liner Hangers consists of the Lane-Wells Quinta-Seal Packers and Liner Hangers, Thin Wall Packers, Anchor Type Formation Packers, Plain and Lead Packer Liner Hangers, as well as special Packers of all types to meet every condition requiring the use of specialized tools.

Hopper Canyon Well Drills at 2900 Ft.

Signal Petroleum Co. has been able to keep its roads open through most of the bad weather and at last reports was down 2900 ft. in its Hopper Canyon wildcat, Hadley No. 7. The well is located on high ground in sec. 13,4-19.

THIS LAUGH

OFF!!

C. Froome tells about the grouchy old cuss who was forced to leave on a long journey before the conclusion of a lawsuit he had brought against a fellow oil man. He left instructions with his lawyer that the verdict should be sent to him by telegraph.

A fews days later he received this telegram: "Right has triumphed."

Immediately he wired back: "Appeal at once."

Which recalls **Harry Gunderson's** story concerning two lawyers.

"You're a cheat!" the first legal light accused his opponent.

"You're a liar!" the other retorted.

Then the judge rapped out: "Now that these attorneys have identified each other, we shall proceed with the case."

"Most girls," said the thoughtful roustie, "attain their ends by not taking enough exercise."

And **Tom Mills** tells us that Egyptian girls who were naughty became mummies.

Mary went up in a plane
Among the clouds to frisk,
Now wasn't she a silly jane,
Her little*

Then there was the girl who sat in front of her mirror for hours in dutiful response to her mother's warning to reflect carefully before going out with that wealthy playboy.

A party of Scots, so **W. Harrison** recounts, decided to make a trip to London, and when they assembled at the station it was found that they numbered 13.

Not wishing to tempt Providence they decided to toss a coin to see who would stay behind.

Unfortunately the coin fell beneath the platform and they all missed the train.

Some keep love letters and love letters keep some.

And **Lloyd Graves** asked us if we had heard about the absentminded scupltor who kissed the statute and chiseled on his wife.

While **Charles Brodersen** tells us about the man who gave his doctor's prescription a glowing testimonial. It seems that the grateful man's wife had been so nervous she could not even sleep in the same room with him, but after drinking a bottle of the prescription she would sleep with anybody.

Which calls to mind the following telephone conversation culled by **A. Louden.**

"Is this the Fidelity Insurance Company?"

"Yes, ma'am, it is. What can we do for you?"

"I want to arrange to have my husband's fidelity insured."

Still, there was that ideal couple **Robt. Plyler** tells about. It seems that she would stand for anything, while he would fall for anything.

A former banker opened a service station and his first customer asked for ten gallons of gasoline.

"Where are you going?" inquired the ex-banker.

The customer explained in detail and the former banker asked:

"Don't you think you could get along with five?"

We are told that there are two kinds of people in the world: the good and the bad. The good decide which is which.

Which brings us to the snappy number who says her boy friend's intentions are no secret even though he does keep her in the dark most of the time.

Overheard at a recent dinner meeting of the A.P.I.'s sub-committee on gas engines:

"It's much better to have to take your meals from the mantel after placing your all on a horse's back, than to have no meals after placing your all on a horse's nose."

WEIGHT INDICATOR POINTS
A BIT BETTER
Manufacturers put the works into drilling bits. Do you get the "works" out of them?
Bit performance is a result of weight, speed, power and mud pressure control. Therefore—good bit performance depends on good instruments with which to control these factors.
That's why—for maximum bit life—you need the complete Martin-Decker "Sealtite" Drilling Control . . . sealed Weight Indicator, sealed Mud Gauge, plus rotary table Tachometer, Torque Gauge and Recorder . . . to accurately control your operations!
MARTIN-DECKER CORP., LONG BEACH, CALIF.

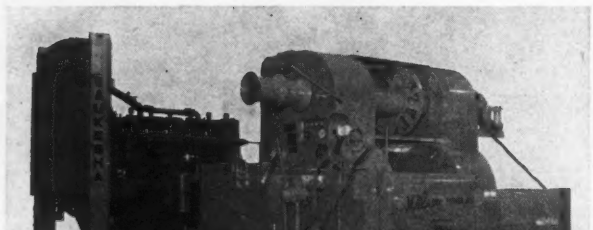


Figure 1. Front view of Wilson "Giant" Drilling Rig showing operating panels and controls.

Figure 2. Rear view of Wilson "Giant" Drilling Rig. Note built-in compressor and centrifugal pump.

Wilson "Giant" Rig Has Many Features

The Wilson "Giant" Drilling Rig shown by the accompanying illustrations was recently delivered to the Shell Oil Co. for use at Dominguez, Calif., by the H & B Sales Co., Long Beach, Pacific Coast Distributor for Wilson products.

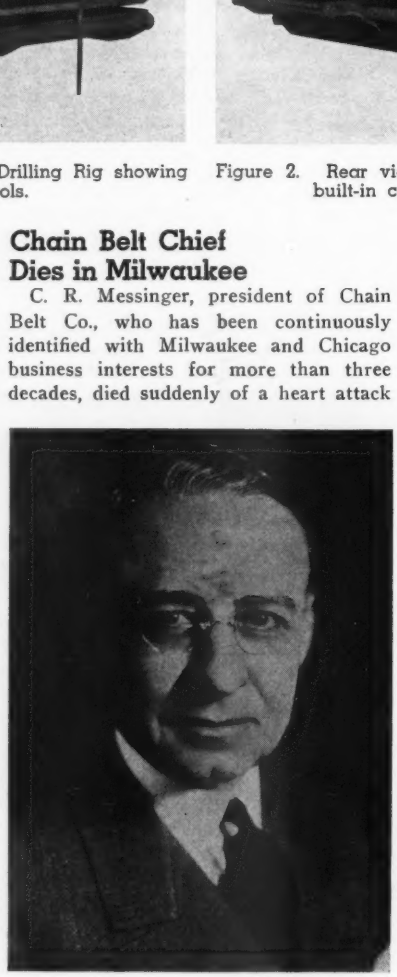
Figure 1 shows the front view, operating panels and controls. This Wilson Rig is powered with a single Waukesha LRO engine and has a built-in sand reel floating on the cathead shaft with the new type Wilson Twin Disc pattern Friction Clutch with built-in forced draft cooling.

Figure 2 shows the same rig from a rear position and illustrates the use of the built-in compressor which provides the means for control of the rig. It also shows the built-in centrifugal pump which circulates the cooling water through the single system for cooling the brakes and friction clutches mounted in each face of the drawworks drum. Both the compressor and pump operates off the big engine power take-off shaft. The compressor has a very unique system for engaging and disengaging its friction clutch drive by a setting which makes the engagement at a pre-determined high pressure and disengages at a pre-determined low pressure of the air receivers. Also shown in this illustration is the new Foster Combination Make and Break Cathead which not only operates the breaking line, but has a separate drum to automatically operate the spinning line—both from the driller's position.

The Mud Pump has another LRO Waukesha engine mounted on a separate unit using the Wilson rubber disc shock ring on the engine flywheel connecting to the drive shaft on which the V-belt pulley is engaged and disengaged by a friction clutch.

Chain Belt Chief Dies in Milwaukee

C. R. Messinger, president of Chain Belt Co., who has been continuously identified with Milwaukee and Chicago business interests for more than three decades, died suddenly of a heart attack



C. R. Messinger

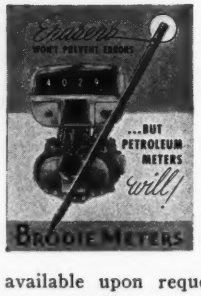
Feb. 4, at his home in Milwaukee. His death followed that of Mrs. Messinger by approximately a month.

In addition to being president of Chain Belt Co., Mr. Messinger was chairman of the Boards of Oliver Farm Equipment Co., Chicago, and Sivyer Steel Casting Co., Milwaukee. He was a director in several other companies, and assistant chief of the Chicago Ordinance District.

Mr. Messinger's initial business experience was in the plant and sales department of the Harbison-Walker Refractories Co. of Pittsburgh. In 1909 he was in charge of Harbison-Walker's Chicago office, but left that company to become secretary of the Sivyer Steel Casting Co. at the time of its organization. He later became vice-president and general manager, then president and general manager, and was chairman of the Board at the time of his death.

At the beginning of 1917 he became affiliated with Chain Belt Co. as its vice president and general manager; he had been named a director the year before. Seven years later, in 1923 he was elected president of Chain Belt Co., and in 1931 became chairman of the board. Late in 1934, on the death of Clifford F. Messinger then president of Chain Belt Co., Mr. Messinger returned as its president and has been its executive head since.

New Bulletin On Metering



A fully illustrated 8-page bulletin analyzing the various causes of stock and time losses and describing the new developments in petroleum marketing equipment is now available upon request. This comprehensive bulletin covers the use of meters on tank trucks, loading racks and in other services, high lighting the specific advantages and applications of Brodie meters, counters and meter accessories.

Copies of this literature may be obtained by writing to Ralph N. Brodie Co., Inc., 979—61st Street, Oakland, Calif., requesting Bulletin No. 142-C.

Engineering, Technology, latest news—twice a month in California Oil World.

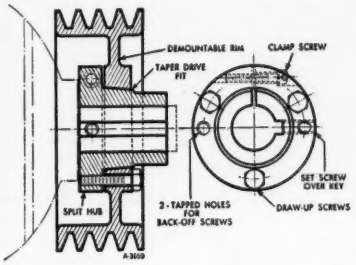
Leeds & Northrup Pyrometer Catalog

A 28-page catalog issued by Leeds & Northrup Co. lists everything needed to check thermocouple pyrometers. It not only illustrates and describes portable equipment for plant tests under actual operating conditions, but the laboratory apparatus to standardize it. Recommendations are also included so that pyrometer users should have little difficulty in choosing checking apparatus best suited to their needs.

A copy will be sent to anyone who asks Leeds and Northrup Co., 4934 Stenton Avenue, Philadelphia, Penn., for Catalog E-33A-503, "Apparatus For Checking Thermocouple Pyrometers."

Worthington Announces New V-Belt Driver Sheave

A new type of V-Belt driver sheave, designated as the Q-D quick detachable and quick demountable type, is announced by Worthington Pump and Machinery Corp., Harrison, N. J., as a standard item in its Multi-V-Drive line. Extreme simplicity of construction is claimed,



and suitability for any application where quick mounting of sheave to shaft, and dismounting from shaft, are desirable; for example, on those classes of equipment where speed ratios must be changed to meet varying conditions. Applications cited are fans, blowers, printing presses, machine tools, and special equipment in the petroleum, paper and textile industries. Also, in general maintenance, it eliminates the necessity of a wheel puller to remove wheel or hub from shaft to get at the driving unit.

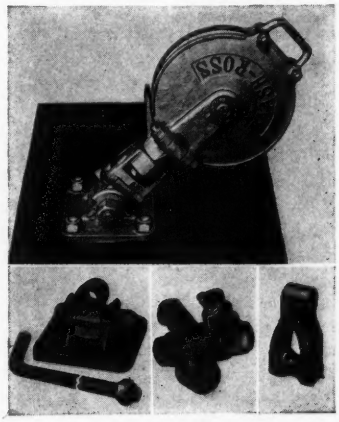
Each sheave unit consists of two parts, a longitudinally-split or clamp hub and a V-grooved rim. The hub is clamped to the shaft by means of a cap screw in its flange and is securely fastened by a standard keyway. A fit equal to a press fit, on shafts up to ten thousandths oversize or under-size, is provided. The rim is taper-fitted to the hub and is fastened with three draw bolts.

To remove the rim, the draw bolts are withdrawn and two of them are inserted in holes so tapped in the rim that the bolts act as jamb screws and bear against the hub, thus forcing the rim off the taper without disturbing the position of the hub. No pounding or prying is required to remove either the rim or the hub. With this equipment, it is claimed that the dangers of battered motor bearings, bent shafts, broken sheaves, and human injury are eliminated.

The type Q-D sheaves are available in the complete range of standard driver sizes and are stocked at convenient points. Descriptive literature will be furnished upon request to the manufacturer.

New Utility Block By Baash-Ross Tool Co.

A new single sheave utility block which can be quickly converted for use as a floor block, as a bailing and coring block, or a tubing block by means of inter-



Baash-Ross Utility Block with Interchangeable Base Plate, Beam Clamp and Clevis.

changeable parts, is manufactured by Baash-Ross Tool Co., 5512 Boyle Ave., Los Angeles, Calif.

The Utility Block is of all steel construction, with tapered roller bearings for the sheave and 360 degree swivel. The sheave is heat treated cast alloy steel or manganese steel, 18-in. O.D. and available grooved for any diameter line 7/8-in. or smaller. The block has a working capacity of 78,000 pounds, with a safety factor of two-to-one, based on the yield point of the material. Integral side plates guard the sheave and prevent the line from jumping the groove. A side-opening feature allows the line to be placed around the sheave easily and without danger of kinking, eliminating threading the line through the block.

When used as a floor block in well servicing work, the Utility Block is designed to be carried on the portable well pulling unit, and to be attached to the base plate which is permanently anchored into the derrick foundations. Attachment is easy, being accomplished by inserting a heavy bolt. The base plate permits the block to move through an arc of 90 dgr. and positive stop against which the block can tilt at an angle of 45 dgr. from the floor in any direction.

The Utility Block becomes a high-speed bailing and coring block when it is attached to the beam clamp and is hung from the base beam of the crown block. Beam clamps are available to fit all sizes of crown block base beams.

For converting the Utility Block for use as a tubing block, a forged steel clevis assembly is supplied. The clevis is free to swing from side to side, but the swivel can be locked by a locking pin when desired.

Swede Nelson Opens Oil Tool & Machine Shop

Swede Nelson, well known oil tool machinist, has opened a general machine shop to serve the Rosecrans area, at 12625 S. Main. St.

A. S. T. M. Tables Cover Viscosities

Two tables recently published by the American Society for Testing Materials are of interest particularly in the field of petroleum products and lubricants; the pamphlets include viscosity index tables and conversion tables for kinematic and Saybolt viscosities and provide in durable and convenient form data which are widely used. Each table is based on and amplified from the respective A.S.T.M. standard methods. The tables were originally compiled by the Standard Oil Development Co.

The index tables (36 pages) provide convenient references to the viscosity index, which is an empirical number indicating the effect of change of temperature on the viscosity of an oil. The index calculated from basic Saybolt Universal Viscosity is tabulated against Saybolt at 100 seconds under Saybolt value at 210 F. for 40 seconds to 161 seconds.

The viscosity conversion tables (16 pages) afford a quick conversion from kinematic to Saybolt Universal Viscosity. The tables range from 2.00 to 330.0 centistokes (32.60 to 1524.6 Saybolt seconds at 100 F.) by increments of 0.01, 0.02, 0.10, and 0.20 depending on the range. Saybolt equivalents at 210 F. are given for a centistoke range of 2.00 to 75.0.

Each of the tables is bound in extra heavy paper cover and printed on durable stock. The index tables may be obtained in quantities of 1 to 9 at 50 cents each; 10 to 24 copies, 40 cents; 25 to 99, 35 cents; 100 and over, 30 cents. The conversion tables are 25 cents each for 1 to 9 copies; 10 to 24, 20 cents; 25 to 99, 17½ cents; 100 and over, 15 cents.

Copies of the above are available from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

Purchasing Personalities

The Hancock Oil Company

By Leo S. Busby
Associate Editor
Southwest Purchasing Agent

Sure, you've all seen things like that. A green oasis in the blistering desert; a snow-capped peak above the sun-parched plains; an emerald island in the broad, blue sea; a single star in the darkening sky; or perhaps, just a lone flower in a field of weeds, or a bright silver dollar in a discarded pair of pants.

Bill Westergard

That's the impression you get when, after picking your way through a forest of oil derricks, and a maze of refineries, supply houses, tanks, boilers and sump holes, you come suddenly upon the general offices of the Hancock Oil Company on Signal Hill.

The building is a beautiful one-story stucco, artistically landscaped with all kinds of shrubs, and a broad expanse of green, velvet lawn. A dwarf hedge near the center of the lawn is trimmed to spell the company name—Hancock. Surrounded on all sides as it is by the realistic implements of its industry, the building seems strangely incongruous, and yet, as the motivating center of activity, it is ideally situated, right smack in the middle of things. And the man who, in a large measure, is the author of this gem of architectural beauty in a setting of pipe, tanks and mud, is the man we're here to talk about—Bill Westergard, purchasing agent of the Hancock Oil Company.

Bill Westergard was born on February 1, 1888, in Omaha, Nebraska, long before the Cornhuskers ever suspected that the Rose Bowl wasn't just something you put flowers in. His education was fostered by the grade and high schools of his home town.

When next we pick up our hero's trail, we find him with General Pershing down at the Mexican border, and both he and Black Jack were trying to find one called Villa, who was, at that time, a big Pancho in the neck for your Uncle Sam. Bill was a civilian assistant to the officer in charge of motor transportation, and since Mr. Villa declined to stick to the good, broad highways, civilian Bill on many occasions had occasion to pick up some very uncivilian language. Just now, Bill would be welcomed with open arms by Major Bowes for his opinion of the Dodge trucks of those days, but, although Bill didn't say so, history records that the best of them were no match for the dodges used by Senor Villa.

In 1917, Bill came west to California, and when Uncle Sam drew cards in the war to end all wars, Bill tried to play a hand. However, he was physically ineligible for enlistment, and so secured a civilian post in the Quartermaster Corps at Camp Kearney. After the war, Bill did several things. He tried real estate, he worked up to a teller's cage in the First National Bank, he sold stocks and bonds. And then in 1927, having tried about everything else, he heard about a little oil company down at Long Beach, and decided that maybe a shot of oil was just what the doctor ordered.

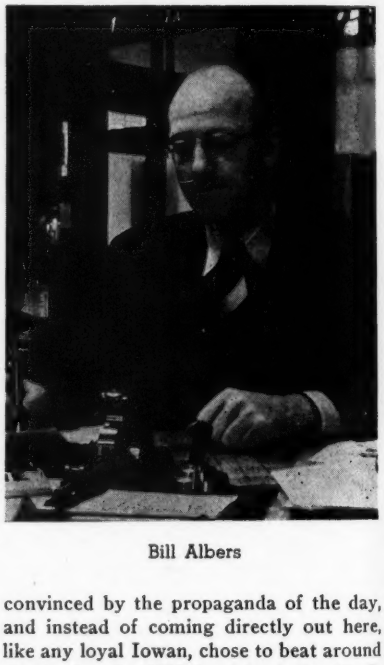
The Hancock Oil Company was organized about September, 1922, and when Bill joined the company in 1927, when the company's first drilling operations commenced, he began work in the main office. At that time, the several departments were doing their own buying, and soon Bill was assigned to coordinate this function. In no time, he was building warehouses, pipe racks, garages, and even supervised the construction of the general office building itself. He now has charge of all procurement functions, together with supervision of warehouses, salvage operations, shops, transportation, and building maintenance.

Bill Westergard, as he is today, is a mild-mannered, soft-spoken gentleman of engaging graciousness. But perhaps we were misled. Bill told us with a great display of chest expansion about news just received from his son in Houston, Texas. It's a baby girl, he says, and we suspect that Grandpa Bill has gone into training for the moment when he'll first hold in his arms that tiny, little Lone Star gusher.

Bill makes his home in Long Beach and professes to a mild weakness for fishing, hunting and golf. Sometimes when he has a tough time staying on the fairway, he combines all three. He is a member of the Masonic order, and holds a membership card in the Pacific Coast Club, an affiliate of the Los Angeles Athletic Club.

To most of us, life is just one bill after another. In the Hancock Oil Company purchasing department it's that way, too, for Bill Westergard's assistant is a friendly gent named Bill Albers.

William E. Albers, as he signs the payroll, is a native Iowan of 1901 vintage. He was educated at Iowa State University where he first learned about Long Beach, California. However, he was unconvinced by the propaganda of the day, and instead of coming directly out here, like any loyal Iowan, chose to beat around the bush. In 1919 he joined the U. S. Army and headed for Long Beach, stopping for indefinite periods at Panama, China, Hawaii, and the Philippines. (War Department please copy!) When he finally made it, the calendar in the Long Beach postoffice showed 1927.



Bill Albers

But late as he was, it seems the American Wholesale Hardware Company was waiting for Bill Albers. In two days, he was head over heels in nails, and putty, and glass, and for eight years when anyone said "American" to Bill, it was just the name of a bunch of nuts and screws, like some guys overseas think it is today.

In 1935, Bill's hard work in hardware began to wear on him. One day, by way of relaxation, he took a stroll up on Signal Hill and stumbled on Bill Westergard's oasis in the oil sumps. He was captivated. He was enraptured. He refused to leave. They had to hire him, and so they made him Bill Westergard's assistant.